Using the Model 281xSA Ethernet Hub

Bay Networks, Inc.

4401 Great America Parkway
Santa Clara, CA 95054
408-988-2400

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Compliance with the applicable regulations is dependent upon the use of shielded cables. The user is responsible for procuring the appropriate cables. Read instructions for correct handling.

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Preface

Congratulations on your purchase of the SynOptics® Model 281xSA Ethernet Hub. These standards-based 10BASE-T hubs provide networking solutions for low- and medium-density 10BASE-T networks that use Simple Network Management Protocol (SNMP) network management.

Purpose

This guide describes how to install and use the Model 281xSA Ethernet Hub, including configuration rules for connecting Ethernet stations and making network interconnections.

Configuration procedures for IP/IPX networks include instructions on how to prepare the hub for configuration, an explanation of how to use configuration menus, and descriptions of specific configuration menus and commands.

Before installing the Model 281xSA hub, read Chapter 3, "Network Configurations and Cable Connections," to plan the placement and connection of hubs and Ethernet stations.

Throughout this guide, *System 2000* or *Model 28xx hub* is used to refer to the Model 2803, 2804, 2813SA, or 2814SA hub, and Model 281xSA hub refers to either the Model 2813SA or the Model 2814SA Ethernet Hub. Where a reference is specific to one of the models, the specific model number is used.

Audience

This guide is intended for network installers or administrators who are responsible for configuring, installing, or maintaining an Ethernet network with Model 281xSA hubs. These individuals should have the following background and experience:

- Working knowledge of SNMP networking
- Familiarity with setting up Ethernet, 10BASE-T, IP, and IPX networks

Conventions

This section describes the conventions used in this guide.

Special Message Formats

This guide uses the following formats to highlight special messages:

NOTE: *This format is used to highlight information of importance or special interest.*

CAUTION: *This format is used to highlight information that will help you prevent equipment failure or loss of data.*

WARNING: *This format is used to highlight material involving possibility of injury or equipment damage.*

Two-tiered Procedure Format

The procedural steps in this guide are presented in a two-tiered format. The first tier describes the step very briefly, but precisely. An experienced user may only need to read the first tiers to complete the task. The second tier describes the step in more detail and may include results of performing the step.

Use of Enter, Type, and Press

This guide uses enter, type, and press to describe the following actions:

- When you read “enter,” type the text and press the Enter key.
- When you read “type,” type the text, but do not press the Enter key.
- When you read “press,” press only the alphanumeric or named key.

Other Conventions

This guide uses the following typographical conventions:

italics	Configuration file parameters; book titles; and UNIX file, command, and directory names.
bold	Configuration file keywords.
`courier font`	Screen text, user-typed command-line entries.
Initial Caps	Menu titles and window and button names.
[Enter]	Named keys in text are shown enclosed in square brackets. The notation [Enter] is used for the Enter key and the Return key.
[Ctrl]+C	Two or more keys that must be pressed simultaneously are shown in text linked with a plus (+) sign.
ALL CAPS	DOS file and directory names.

Related Publications

For more information about Ethernet networks, refer to the *LattisNet System 3000 Ethernet Connectivity Guide* (SynOptics part number 893-211-B). For more information about network management, refer to the documentation that was shipped with your SynOptics network management software.

To purchase SynOptics product publications, order by part number from SynOptics Press at the following numbers. You may also request a free catalog of SynOptics Press product publications.

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- Europe: 011-31-3480-31616
- Rest of the world: 408-764-1000

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- U.S. and Canada: 1-800-786-3228
- International: 408-764-1002

You can also access technical information in the SynOptics forum on CompuServe.

For information about our education services, contact the SynOptics Training Coordinator at 1-800-473-4911 or 408-764-1018.

Chapter 1 Overview of the Model 281xSA Hub

The Model 2813SA and 2814SA Ethernet Hubs (see Figure 1-1 and Figure 1-2, respectively) are preconfigured for plug-and-play operation. These workgroup hubs support 10BASE-T Ethernet in a manageable, physical star configuration using a building's existing premises wiring. Model 281xSA Ethernet Hubs offer a cost-effective solution for high-power, low-density 10BASE-T departmental segments, as well as the flexibility and expandability to support medium-density 10BASE-T workgroups operating within a large enterprise network.

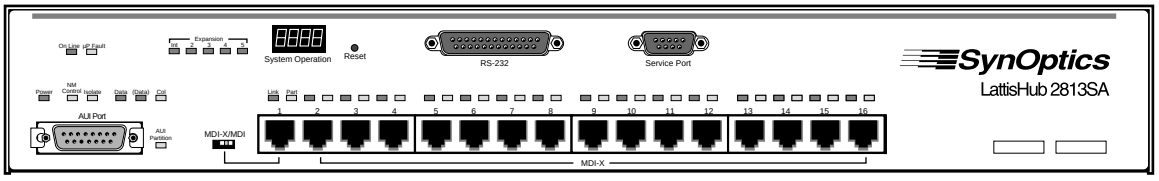

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Figure 1-1. Model 2813SA Ethernet Hub

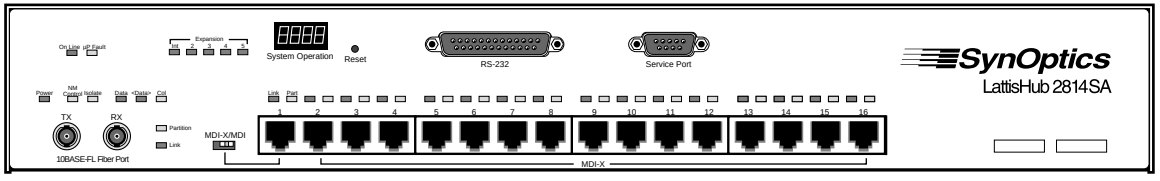

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Figure 1-2. Model 2814SA Ethernet Hub

The Model 281xSA Ethernet Hub includes fully integrated SNMP-based Advanced Analyzer network management capabilities compatible with SynOptics network management software or other SNMP-compatible network management software.

This chapter includes the following topics:

- A list of features of the Model 281xSA hub
- A summary of Model 281xSA hub functions
- Descriptions of management options for the Model 281xSA hub

Features

Each Model 281xSA Ethernet Hub has the following features:

- Support for all RMON groups except packet capture and filter
- Flash memory that allows local loading of image and configuration data
- Sixteen IEEE 802.3i 10BASE-T ports:
  - Shielded modular RJ-45 jacks for unshielded twisted pair (UTP) cable or shielded twisted pair (STP) cable using a Model 822 10BASE-T-to-Type 1 Adapter
  - MDI/MDI-X configuration switch for port 1 to connect the Model 281xSA hub directly without using an external crossover cable or adapter
  - MDI-X-only configuration for ports 2 through 16
  - Per-port automatic link integrity test function
  - Per-port automatic disconnection (autopartition) of a port for too many consecutive collisions or a collision that is too long)
  - Automatic +/– polarity detection and correction of the receive data wire-pair for each port
- One AUI port (on the Model 2813SA hub) for connecting an Ethernet IEEE 802.3 transceiver—allowing connection to another network hub, station, or segment using coaxial, fiber optic, or twisted pair cable

  or
- One optical port (on the Model 2814SA hub) for direct connection to fiber optic cable
- Front-panel LEDs displaying link and partition status of each port, power status, data activity, collision, and AUI partition or fiber optic link status
- Front panel system operation display showing network utilization
- Front-accessible reset button
- One service port, implemented on a DB-9 plug, for connection of a terminal

- One standard RS-232 serial communications port, implemented on a DB-25 plug, for out-of-band connection to the telephone voice network through an external modem
- Installation options on a table, on a wall, or in a standard 19-inch equipment rack
- One local area network interface processor (LANIP) chip to collect network and station statistics, monitor functions, and provide SNMP communication for one Ethernet segment
- Dual-stack agent support for SNMP monitoring and control over both IP and IPX network protocols
- Bootstrap Protocol (BootP) automatic boot and download protocol support using Trivial File Transfer Protocol (TFTP)
- Boot firmware that allows separate downloading of agent image and configuration data

Functional Description

The System 2000 10BASE-T hubs offer a unique, scalable architecture that allows small networks to grow easily to accommodate additional users. Single hubs can serve as standalone units to support entry-level departmental 10BASE-T LANs. As network requirements grow, the initial investment is maintained by the unique expansion connection capability of the System 2000 hub. Hubs can be connected through special expansion ports that extend management control to all ports in the network cluster while the cluster remains as one logical IEEE 802.3 Ethernet repeater. The expansion connections allow a more “modular” architecture to extend per-port SNMP management functionality at a low incremental cost.

Because the IEEE sets a limit of four Ethernet repeaters between any two stations, traditional workgroup hubs cascaded together to form larger segments typically run into this configuration limitation. With the System 2000 hubs, all of the expansion-connected hubs within the cluster support distributed retiming, allowing the whole cluster to remain as one logical repeater. The System 2000 hubs support up to 80 users in an expansion cluster.

Management Functions in the Model 281xSA Hubs

The Model 281xSA hubs are part of a family of Ethernet SA management products that provide Advanced Analyzer functionality across the range of connectivity product families. In these products, dedicated hardware for packet capture and analysis frees the network interface to run SNMP communication under conditions of extreme network load. This “probe in a hub” architecture brings high-power RMON and RMON+ monitoring and analysis capability into the workgroup environment.

Dedicated Data Collection

The Model 281xSA hub incorporates SynOptics-developed application-specific integrated circuit (ASIC) technology for packet capture and analysis. Called the LANIP chip, this chip works as a data collection engine and is designed to offload the main network management CPU from maintaining CPU-intensive network statistics. The LANIP chip monitors all incoming packets and records selected statistics in realtime on a per-port basis. The programmable packet slices are moved to a shared buffer that the agent can access for management.

SNMP-based Management

The Model 281xSA hub implements SNMP, the standard communications protocol that simplifies the management of network devices linked together in a multivendor networking environment. SNMP agents reside in network devices and respond to queries sent by network management software running on a management station. The management station collates the results of these queries and presents them graphically on the management station display.

In the Model 281xSA hub, the network management board gathers configuration and control data across the cascade network management interface (CNMI) bus and uses the LANIP chip to gather network-level performance and control data. Then the network management board forwards the data to a network management station, where network managers can use the data for network planning and for diagnostic operations.

Refer to your network management system documentation for more information on this level of network management capability.

Agent Software

The agent software resident on the Model 281xSA hub uses the information collected by the LANIP chip to provide full management for the network segment to which it is connected. The basic role of the agent software is to:

- Gather statistics on network communications and activities.
- Analyze and reduce the statistics and store them locally.
- Communicate with the management station to transfer the collected statistics; provide configuration, status, and control information; or act on requests from the management station.

Teamed with the SynOptics network management software—or other SNMP-compatible network management software—the network management agent allows you to observe and configure the following items:

- Flow and quality of network data
- Network topology
- Physical components, such as cables and hubs
- Faults, errors, and hardware status

This level of network management also enables you to detect and correct network faults, as well as to isolate, monitor, and reconfigure specific network branches.

The Model 281xSA hubs store the agent software in onboard flash memory. This feature allows software upgrades to be handled over the network from a central management station and eliminates the physical swapping of ROMs. The Model 281xSA hubs support both IP and IPX network management. IPX support enables network managers to install and manage Model 281xSA hubs in Novell Netware environments without needing to learn and administer IP networking principles.

MIB-II

MIB-II allows any vendor's network management station to query important system configuration information, as well as IP and SNMP counters and statistics. The Model 281xSA hub supports MIB-II groups including system, interfaces, address translation, IP, ICMP, UDP, and SNMP.

Support for SynOptics Optivity Features

The Model 281xSA hubs are fully compatible with network management functions provided by the SynOptics Optivity network management software. In particular, the Model 281xSA hubs support the Expanded View™, Autotopology™, Show Nodes/Find Nodes, and Allowed Nodes features. These hubs also allow the network administrator to set various thresholds for error counters.

Expanded View

Expanded View offers extensive Ethernet fault, configuration, and performance management from anywhere in the network.

Autotopology

Autotopology provides accurate realtime display of the physical layout of the network by detecting and reporting all network management modules located on the network. Model 281xSA hubs also provide IPX Autotopology in addition to standard IP Autotopology.

The details of Autotopology vary according to the platform on which the Optivity software is running. Consult the publications that were shipped with your Optivity software for more information.

Show Nodes/Find Nodes

The Show Nodes command is an Optivity feature that displays a window showing all the nodes in the current view and in any subviews. The Find Nodes command is an Optivity feature that displays a window you can use to locate an object by its name or media access control (MAC) address.

Allowed Nodes Security

The Allowed Nodes security feature prevents unauthorized nodes from accessing the network. This node security function consists of the Intrusion Control feature and the Allowed Nodes list.

Intrusion Control specifies whether or not the network management agent should look for unauthorized addresses, and what action to take when one is detected. This security feature can be applied at the hub, slot, or port level.

The Allowed Nodes list contains the MAC addresses of devices that are allowed to send packets into the hub. Each address has a slot and port assignment. Using zero as the slot or port number indicates that the address is allowed on any port in the hub or slot, respectively.

Thresholds

User-configurable thresholds on individual isolating or nonisolating errors, connection status, and use can be set per port, per hub, or on the entire segment. The 281xSA agent software supports up to 288 thresholds per hub, allocated any way the administrator chooses. Thresholds can be applied to any error counts kept by the LAN interfaces or host modules.

Model 281xSA hubs can also be configured with "ratio" thresholds that allow settings for the ratio of bad packets, network errors, or collisions to good packets. The hubs further support additional threshold types such as rate gauges.

Service Port Management

The service port, located on the front panel of the Model 281xSA hub, provides a serial communication link to the hub. By connecting a terminal to this port, you can change the boot and run-time configuration parameter values for the network management functions in the hub.

For more information on connecting to the service port to manage network management modules, refer to "Using the Service Port" in Chapter 4, "Configuring the Model 281xSA Hub for IP/IPX Networks."

For more information on setting boot and run-time configuration parameters, refer to Chapter 4, "Configuring the Model 281xSA Hub for IP/IPX Networks."

Chapter 2 Installing the Model 281xSA Hub

This chapter describes how to install the Model 281xSA hub. This chapter includes information on the following topics:

- Preparing the installation site
- Unpacking the equipment
- Installing the hub on a table or shelf
- Attaching wall-mounting brackets and installing the hub on a wall
- Attaching rack-mounting brackets and installing the hub in an equipment rack

NOTE: *Only qualified technicians should install and maintain this equipment.*

If you have ordered additional memory for your Model 281xSA hub, it is a good idea to install the new SIMM before you proceed with the hub installation. You can upgrade the memory on the Model 281xSA hub at any time, but you must open the hub cabinet to gain access to the SIMM socket. For instructions on installing SIMMs, see Appendix I, “Replacing SIMMs.”

Site Preparation

Before you begin installing the Model 281xSA hub, prepare the installation site. Evaluate the operating environment and make sure the location meets the physical requirements of the chassis.

Operating Environment Requirements

Make sure the area where you intend to install the Model 281xSA hub provides the following environmental conditions:

- Temperature
  - Ambient temperature between 5° and 40° C (41° and 104° F)
  - No nearby heat sources such as direct sunlight, warm air exhausts, or heaters
- Humidity
  - Between 5% and 85% noncondensing
- Ventilation
  - Minimum 2 inches on all sides for cooling
  - Adequate airflow in room or wiring closet
- Operating conditions
  - At least 6 feet to nearest source of electromagnetic noise (such as photocopy machine or arc welder)
  - No dust

Physical Location Requirements

There are certain physical requirements for installing the Model 281xSA hub, whether you are installing the hub on a table, in a rack, or on a wall. Make sure your location meets the following requirements:

- Service access
  - Minimum 12 inches front and rear for service access and maintenance
  - Front and rear clearance for cables and wiring hardware such as punchdown blocks
- Power
  - Adequate power source within 6 feet
- Table installation requirements
  - Approximately 10-inch by 18-inch area on a level tabletop or shelf
  - Support for at least 10 pounds

- Rack installation requirements
  - Standard 19-inch EIA equipment rack
  - One and one-half EIA spaces available for each Model 281xSA hub
- Wall installation requirements
  - Half-inch plywood (minimum size of 6 inches by 20 inches) secured to the wall where you plan to attach the hub
- Wiring hardware
  - Wiring hardware, such as punchdown blocks or patch panels, in place before installing the hub

Package Contents

Before you begin installing the Model 281xSA hub, check to see that you have the following items (see Figure 2-1):

- Model 281xSA Ethernet Hub
- Two rack-mounting brackets
- Two wall-mounting brackets
- Installation hardware:
  - Five #4-40 x 5/16 flat-head Phillips screws for attaching mounting brackets (one extra)
  - Four #10-32 x 3/4 pan-head Phillips screws and nylon washers for rack mounting
- Power cord
- This user's guide
- Release notes
- Warranty card

CAUTION: *The power cord is a North American type, UL-listed/CSA-certified power supply cord. Immediately discard this cord if it is inappropriate for your country's electrical system, and obtain the proper cord as required by your national electrical codes or ordinances.*

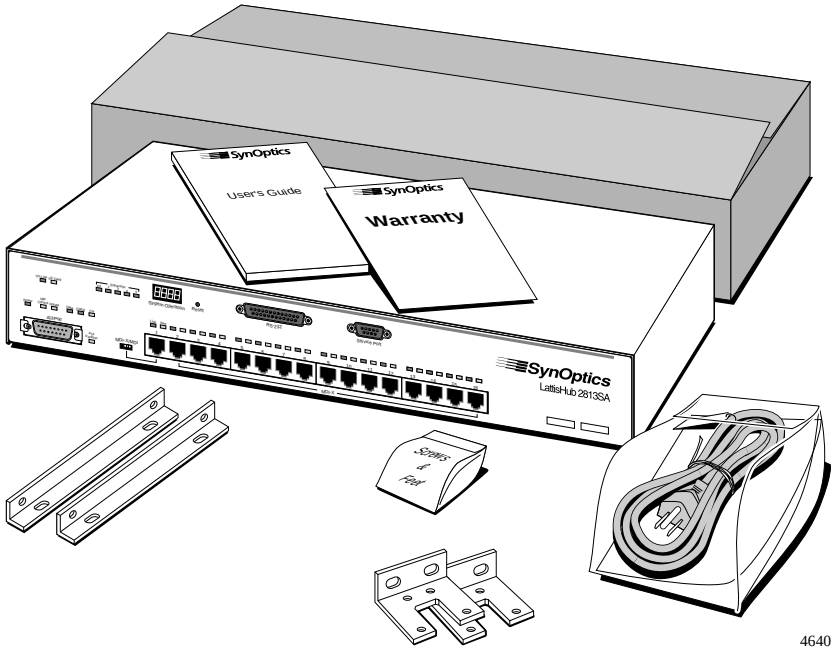

Figure 2-1. Model 281xSA hub package contents

If any listed items are missing or damaged, contact the sales or customer service representative from whom you purchased your Model 281xSA hub.

Required Tools and Materials

To install the Model 281xSA hub, you need the following tools and materials:

- #1 Phillips screwdriver for attaching mounting brackets
- #2 Phillips screwdriver for tightening rack-mounting screws
- For wall installation:
  - Piece of plywood approximately 6 inches by 20 inches (minimum 1/2 inch thick)
  - Drill
  - Four #12 x 5/8 pan-head Phillips sheet metal screws
- Antistatic mat and wrist strap (attached to an antistatic leash) to protect electronic components from static electricity damage

Table or Shelf Installation

To install the Model 281xSA hub on a table or shelf, follow these steps:

1. **Peel off the protective backing from the rubber feet and apply one at each marked location on the bottom of the hub (see Figure 2-2).**

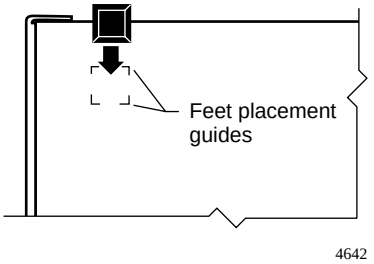

Figure 2-2. Attaching feet

2. **Set the hub on a table or shelf so that it has at least 2 inches of space on all sides.**

3. **Connect the power cord, first to the power entry receptacle on the back of the hub (see Figure 2-3) and then to the wall.**

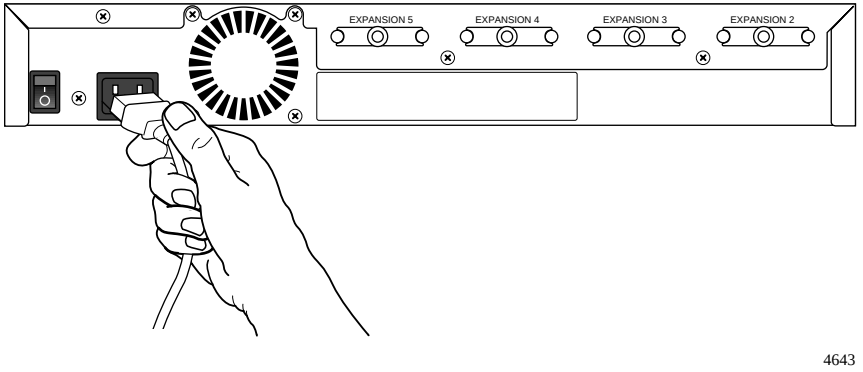

Figure 2-3. Connecting the power cord

4. **Turn on the power switch.**
5. **Check the Power LED on the front panel (see Figure 2-4).**

   If this LED does not light, contact your customer support representative.

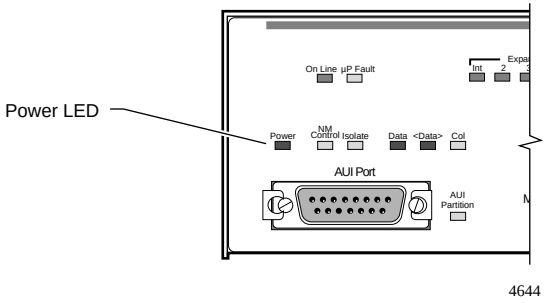

Figure 2-4. Power LED

At this point, the hub is ready to have the network cables connected. See Chapter 3, “Network Configurations and Cable Connections,” for information on completing the network installation.

Rack Installation

To install the Model 281xSA hub in an equipment rack, follow these steps:

1. Attach the mounting brackets.

a. On each side of the hub, use a #1 Phillips screwdriver to remove the screws at the front corner (see Figure 2-5).

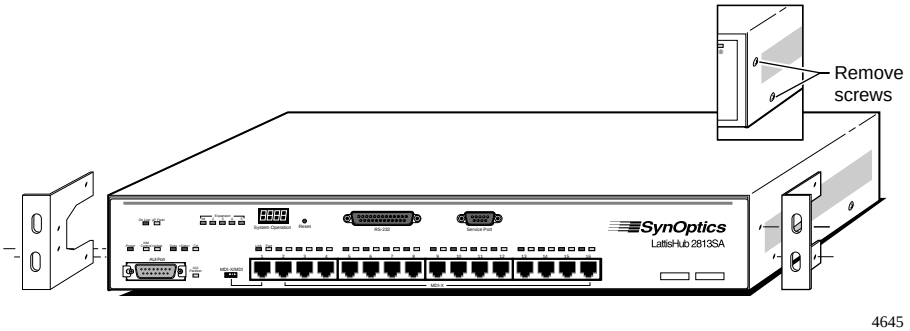

Figure 2-5. Attaching brackets for rack installation

b. Hold a mounting bracket against each side of the hub, as shown in Figure 2-5, and align the countersunk screw holes in the bracket with the bracket mounting holes in the hub.

The bracket covers a few of the chassis ventilation holes. This does not compromise the cooling of the hub.

c. Insert two #4-40 x 5/16 flat-head screws through each bracket and into the bracket mounting holes in the hub cabinet.

d. Using a #1 Phillips screwdriver, tighten the screws to secure each bracket.

2. Install the hub in the rack.

a. Hold the hub with the mounting holes in the brackets aligned with holes in the rack (see Figure 2-6).

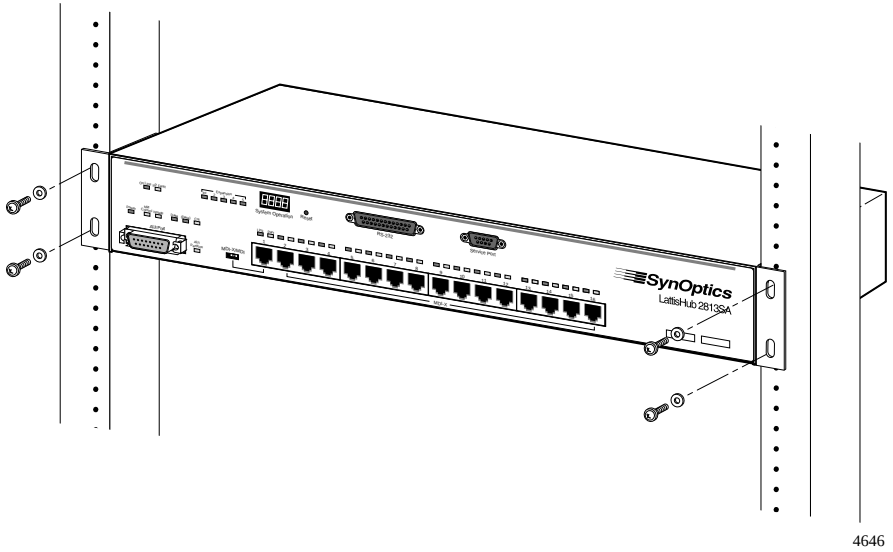

Figure 2-6. Installing the hub in an equipment rack

b. Insert two #10-32 x 3/4 pan-head screws with nylon washers through each bracket and into the rack.

c. Using a #2 Phillips screwdriver, tighten the screws to secure the hub to the rack.

3. **Connect the power cord, first to the power entry receptacle on the back of the hub (see Figure 2-7) and then to the power outlet.**

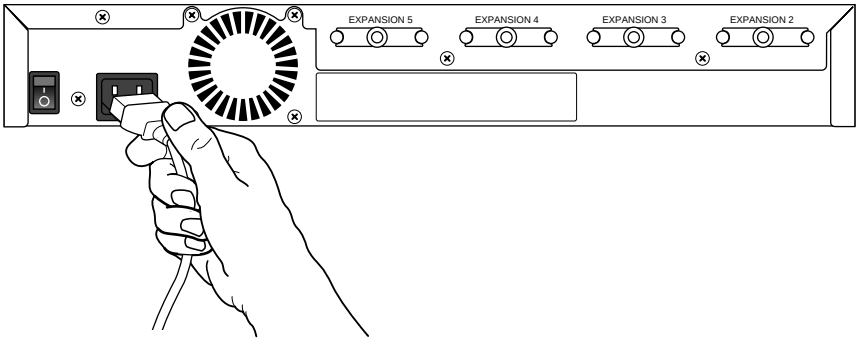

Figure 2-7. Connecting the power cord

4. **Turn on the power switch.**

5. **Check the Power LED on the front panel (see Figure 2-8).**

   If this LED does not light, contact your customer support representative.

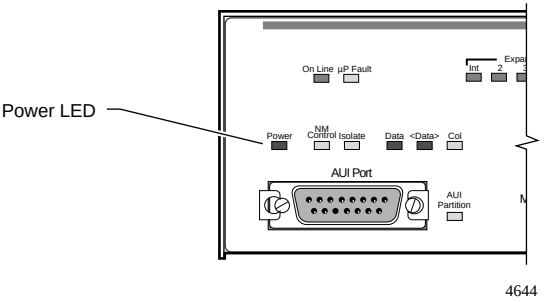

Figure 2-8. Power LED

At this point, the hub is ready to have the network cables connected. See Chapter 3, “Network Configurations and Cable Connections,” for information on completing the network installation.

Wall Installation

In a wall installation, the Model 281xSA hub must be mounted on a wooden surface. Make sure half-inch plywood is securely attached to the wall where you intend to install the hub.

NOTE: *You must supply four #12 x 5/8 pan-head Phillips sheet metal screws for wall mounting the Model 281xSA hub.*

To install the Model 281xSA hub on a wall, follow these steps:

1. **Attach the mounting brackets.**

   a. Using a #1 Phillips screwdriver, remove the two bottom screws on each side of the hub (see Figure 2-9).

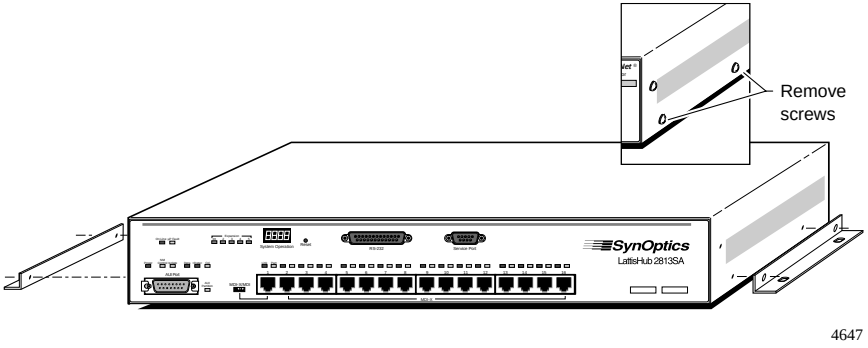

Figure 2-9. Attaching brackets for wall mounting

   b. Hold a mounting bracket against each side of the hub where you removed the screws, as shown in Figure 2-9, and align the countersunk screw holes in the bracket with the bracket mounting holes in the hub.

   c. Insert two #4-40 x 5/16 flat-head screws through each bracket and into the bracket mounting holes in the hub cabinet (see Figure 2-9).

   d. Using a #1 Phillips screwdriver, tighten the screws to secure each bracket.

2. Prepare the wall for installing the mounting screws.

a. Using Figure 2-10 as a guide, mark the mounting screw locations on the plywood where you plan to install the hub.

b. Drill pilot holes at the marked locations.

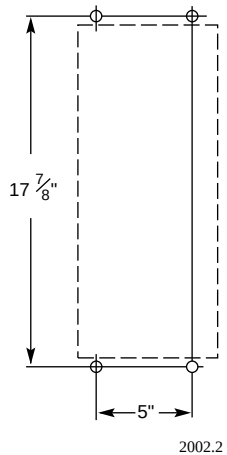

Figure 2-10. Template for wall mounting

3. Holding the hub against the plywood, align the bracket holes with the pilot holes in the wood.

4. Insert and tighten the sheet metal screws (see Figure 2-11).

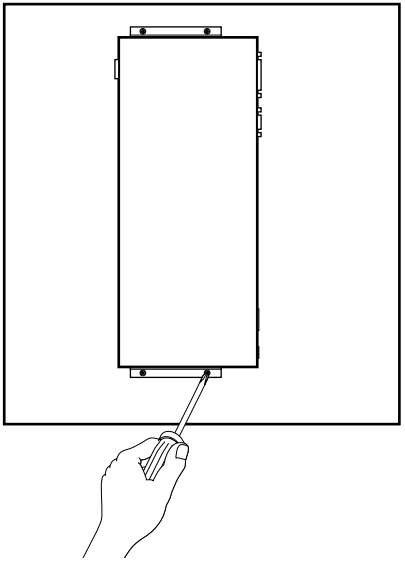

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Figure 2-11. Securing the Model 281xSA hub to the wall

5. Connect the power cord, first to the power entry receptacle and then to the wall outlet (see Figure 2-12).

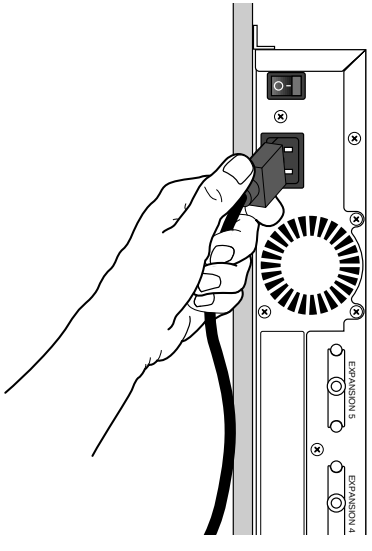

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Figure 2-12. Connecting the power cord

6. **Turn on the power switch.**

7. **Check the Power LED on the front panel (see Figure 2-13).**

   If this LED does not light, contact your customer support representative.

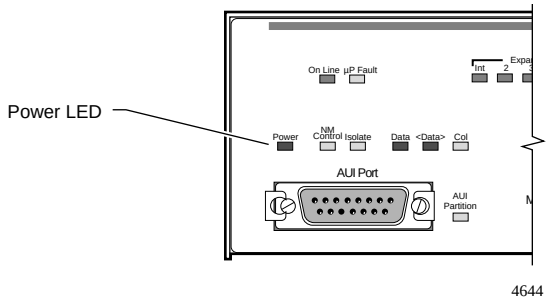


Figure 2-13. Power LED

At this point, the hub is ready to have the network cables connected. See Chapter 3, “Network Configurations and Cable Connections,” for information on completing the network installation.

Chapter 3 Network Configurations and Cable Connections

This chapter provides general requirements and recommendations for proper network configurations using the Model 281xSA Ethernet Hub. The chapter summarizes the possible expansion of a network from a single-hub network to one that encompasses several clusters and includes System 3000 equipment. Single-hub, cluster, and multiple-hub networks are described, as well as configuration rules for each type. Each network configuration description is followed by instructions for making the cable connections necessary for that configuration.

The installation procedures in this chapter assume that UTP horizontal distribution cables are already installed, providing connection from the work area wall outlet to the wiring closet punchdown blocks, and that cables are properly identified. Normal cabling system practices are assumed; your installation procedure may vary slightly, depending on your particular cabling system.

This chapter includes the following topics:

- A summary of how networks can expand from one hub to many
- A description of a typical single-hub network, with instructions for making the necessary cable connections
- A description of the System 2000 cluster configuration and instructions for connecting hubs into a cluster
- Instructions for connecting multiple System 2000 hubs and clusters to form a larger network
- Examples of typical networks that use System 2000 and System 3000 equipment

Building Network Configurations

The simplest type of System 2000 network is a small standalone network that does not require SNMP-based network management. Starting with a single Model 280x hub, you can connect a maximum of 16 10BASE-T stations to a local Ethernet segment. Local hub management in the Model 280x hub provides monitoring and control functions through an easy-to-use ASCII terminal interface. As the number of users on the segment grows to greater than 16, multiple Model 280x hubs can be interconnected via the MDI-X/MDI switchable port 1, or through the AUI or fiber backbone interconnect ports. (For a description of how to use the MDI-X/MDI port, see Appendix B, "LEDs and Switches.") However, as the network grows, so does the need for management. As you increase the station count, the ability to add SNMP management support becomes increasingly important.

At this point, you can add a single Model 281xSA hub and connect up to four Model 280x hubs through expansion ports, creating a Model 281xSA/280x hub cluster. This arrangement provides Advanced Analyzer SNMP management for all stations (up to 80) connected to the cluster. It also increases the number of available ports in two ways:

- This configuration adds the 16 ports on the Model 281xSA hub to the total number of available ports.
- The cluster frees the MDI-X/MDI ports on the hubs for station connections (if you were formerly using the MDI-X/MDI ports for interconnection).

Perhaps the most important feature of this cluster, in terms of future expansion capabilities, is that by using the expansion ports to cluster the hubs, you have reduced to one the number of repeaters in the cluster. The retiming function is distributed among all units in the cluster, and the cluster operates in the network as a single logical IEEE 802.3 repeater.

To increase the network size beyond 80 ports, you can begin interconnecting the cluster to other hubs. Because System 2000 hubs are compatible with other System 2000 and System 3000 products, they can be used to connect a 10BASE-T workgroup into a larger enterprise network. Clusters can serve as a local workgroup in a very large network using larger hubs, or clusters themselves can be interconnected. Clusters are treated like single hubs in these configurations.

Single-hub Network

A single-hub network using a Model 281xSA hub provides full SNMP management for up to 16 10BASE-T Ethernet stations. Figure 3-1 shows such a network configuration. In the work area, the Ethernet stations are attached to the UTP horizontal distribution cables through the AUI network interface card (NIC) and 10BASE-T transceivers. A management station is connected to a host port. The maximum allowed length of the UTP cable to an Ethernet station is 100 meters.

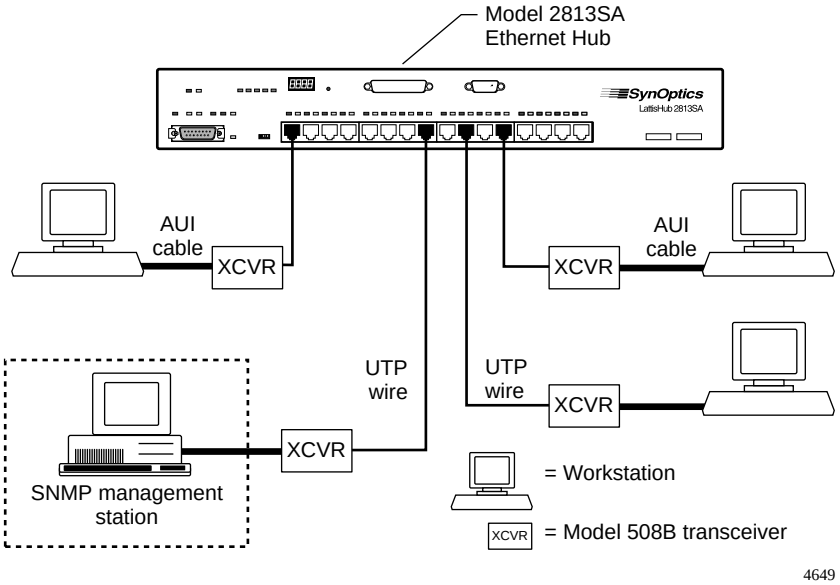


Figure 3-1. Typical single-hub configuration

Ethernet Station Connections

For a single-hub network, the only cable connections are those between the Ethernet stations and the hub. Ethernet station connections are standard for all network configurations, irrespective of the number of hubs used, and are typically made in two locations: in the work area and in the wiring closet.

Cable Connections in the Work Area

The Ethernet station can have one of the following two types of network interface card installed:

- An AUI network interface card
- A 10BASE-T network interface card

Using an AUI Network Interface Card

If you are connecting an Ethernet station with an AUI network interface card, you must use an external 10BASE-T transceiver, such as the SynOptics Model 508B or 928 transceiver.

To connect the station to the premises cabling, follow these steps:

1. **Connect the transceiver to the station.**

   a. If you are using a Model 508B 10BASE-T transceiver, attach an AUI cable (for example, a Model 903A cable) from the interface card to the AUI port of the Model 508B transceiver, as shown in Figure 3-2.

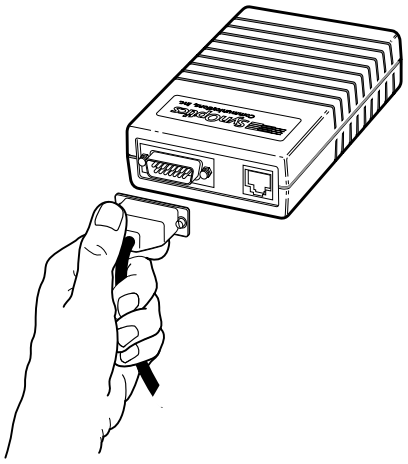


Figure 3-2. Connecting an AUI cable to a Model 508B 10BASE-T Transceiver

   b. If you are using a SynOptics Model 928 integrated transceiver, attach the transceiver directly to the interface card (see Figure 3-3).

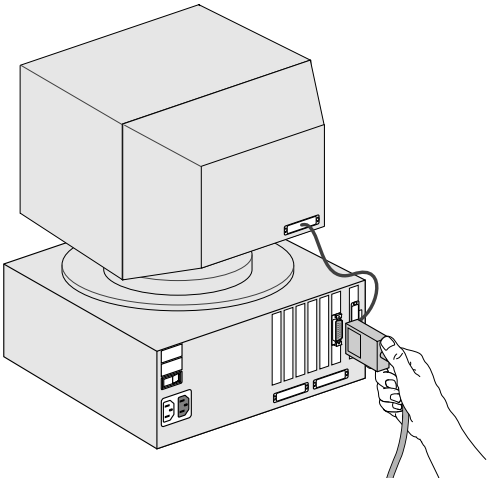


Figure 3-3. Connecting a Model 928 transceiver to a network station

2. Connect the cable between the transceiver and the wall outlet.

a. If you are using a Model 508B transceiver, connect a UTP patch cable (for example, a Model 910 cable) from the RJ-45 port of the transceiver to the RJ-45 connector of the wall outlet (see Figure 3-4).

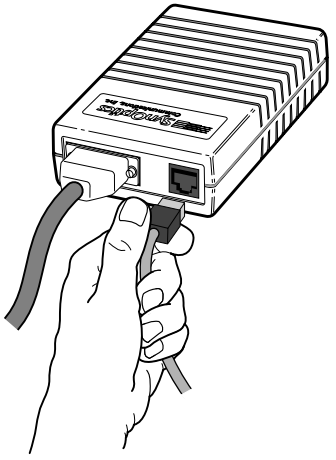


Figure 3-4. Connecting UTP cable to a Model 508B transceiver

b. If you are using a Model 928 integrated transceiver, attach the captive cable on the Model 928 transceiver to the wall outlet (see Figure 3-5).

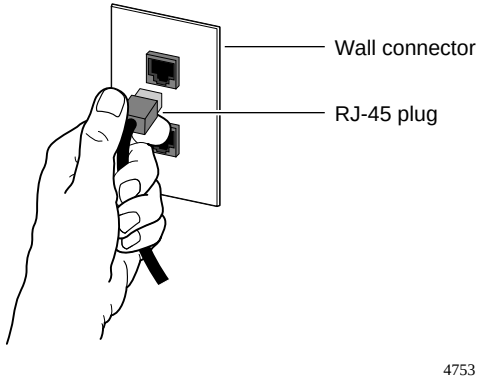


Figure 3-5. Connecting the Model 928 transceiver to the wall

Repeat steps 1 and 2 for each type of station until all Ethernet stations are connected to the UTP horizontal distribution cabling through the RJ-45 connectors of wall outlets.

Using a 10BASE-T Interface Card

If a 10BASE-T network interface card is installed in the Ethernet station, you do not need the external 10BASE-T transceiver and AUI cable. To connect an Ethernet station with a 10BASE-T network interface card, follow these steps:

1. **Connect one end of a UTP patch cable (for example, a Model 910 cable) to the RJ-45 port of the 10BASE-T interface card (see Figure 3-6).**

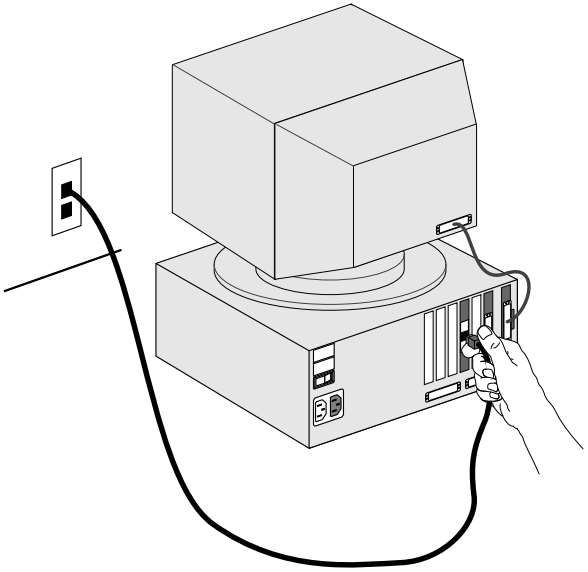


Figure 3-6. Connecting a 10BASE-T interface card

2. Connect the other end to the RJ-45 connector of the wall outlet (see Figure 3-6).

Repeat steps 1 and 2 for each type of station until all Ethernet stations are connected to the UTP horizontal distribution cabling through the RJ-45 connectors of wall outlets.

NOTE: *To connect Ethernet stations to IBM Type 1 STP cable, use the Model 822 10BASE-T-to-Type 1 Adapter. See the Model 822 10BASE-T-to-Type 1 Adapter Reference Sheet for installation details.*

Cable Connections in the Wiring Closet

To complete the connection of each Ethernet station to a 10BASE-T host port on the Model 281xSA hub, follow these steps:

1. Verify that the total UTP segment length (including building wires and all patch cables used on any run between the station and the hub) does not exceed 100 meters.

2. Make sure the MDI-X/MDI switch on each Model 281xSA hub is set to the MDI-X position (see Figure 3-7).

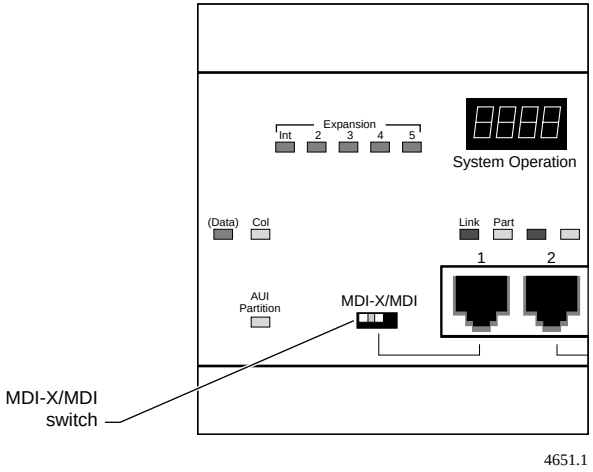


Figure 3-7. MDI-X/MDI switch set to the MDI-X position

The MDI-X/MDI switch is used to swap the pin assignments of the transmit and receive data wire-pairs for port 1. If the remote end of the wire is connected to a network station or to an MDI port on another hub, use the MDI-X configuration. Ports 2 through 16 are internally configured as MDI-X ports. See Appendix B, “LEDs and Switches,” for a more complete description of the MDI-X/MDI switch operation.

3. Connect a 25-pair UTP cable from the punchdown block to a UTP patch panel (see Figure 3-8).

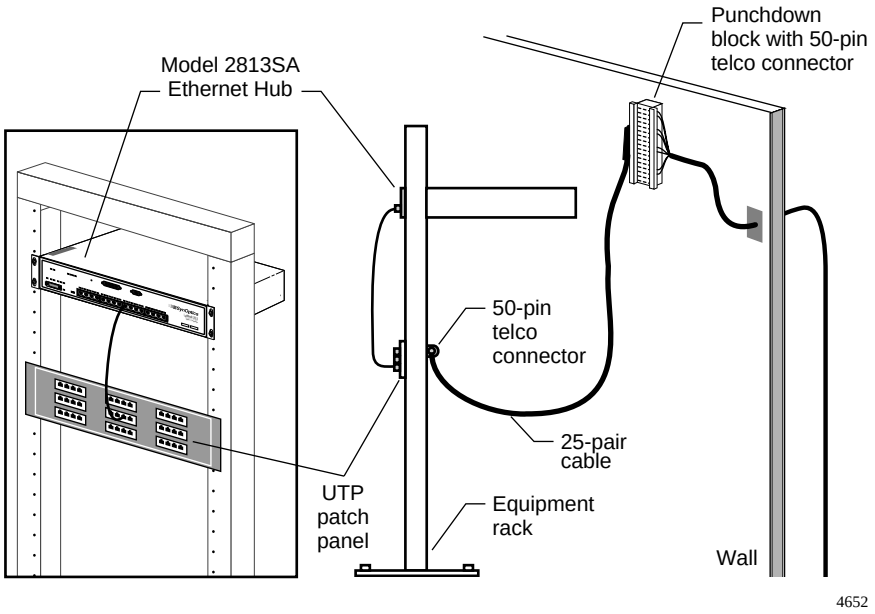


Figure 3-8. Connecting 25-pair UTP cable

4. Connect one end of a UTP patch cable (for example, a Model 910 cable) to the UTP patch panel (see Figure 3-8).

5. Connect the other end to a 10BASE-T port on the Model 281xSA hub (see Figure 3-9).

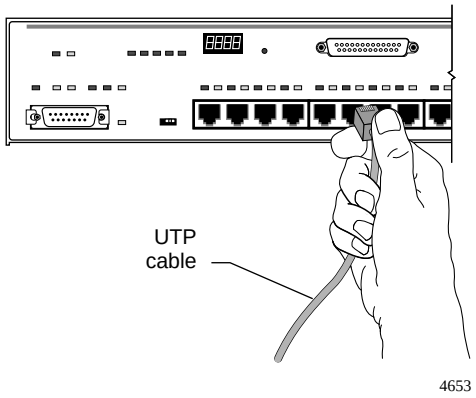


Figure 3-9. Model 281xSA hub 10BASE-T port connection

6. Verify that the port Link LED is ON.

NOTE: *The System 2000 Ethernet hubs support the 10BASE-T specified link integrity test function. See Appendix D, "Link Integrity Test Function," for a complete description of this feature.*

Repeat steps 1 through 6 until all Ethernet stations are connected to 10BASE-T ports on the Model 281xSA hub.

See Appendix C, "Pin Assignments," for the pin assignments of the RJ-45 connector on the Model 281xSA hub.

The System 2000 hubs support automatic polarity detection and correction, which detects and automatically corrects for signal inversions on the UTP receive data wire-pair. If any receive data wire-pair was mistakenly reversed in the punchdown block during cable installation, the System 2000 hub internally corrects for the miswiring, and the data path operates correctly. For more information about this feature, see Appendix E, "Autopolarity Detection and Correction."

Cluster Configurations

To add ports to a network made of a single Model 281xSA hub, or to add network management to a network made of a single Model 280x hub, you can create a Model 280x/281xSA cluster configuration. A cluster configuration (see Figure 3-10) consists of one Model 281xSA hub and one or more attached Model 280x hubs, up to a maximum of four Model 280x hubs. A cluster lets you build the network from a starting point of 16 or fewer stations to a maximum of 80 stations, and extend network management to all 80 stations.

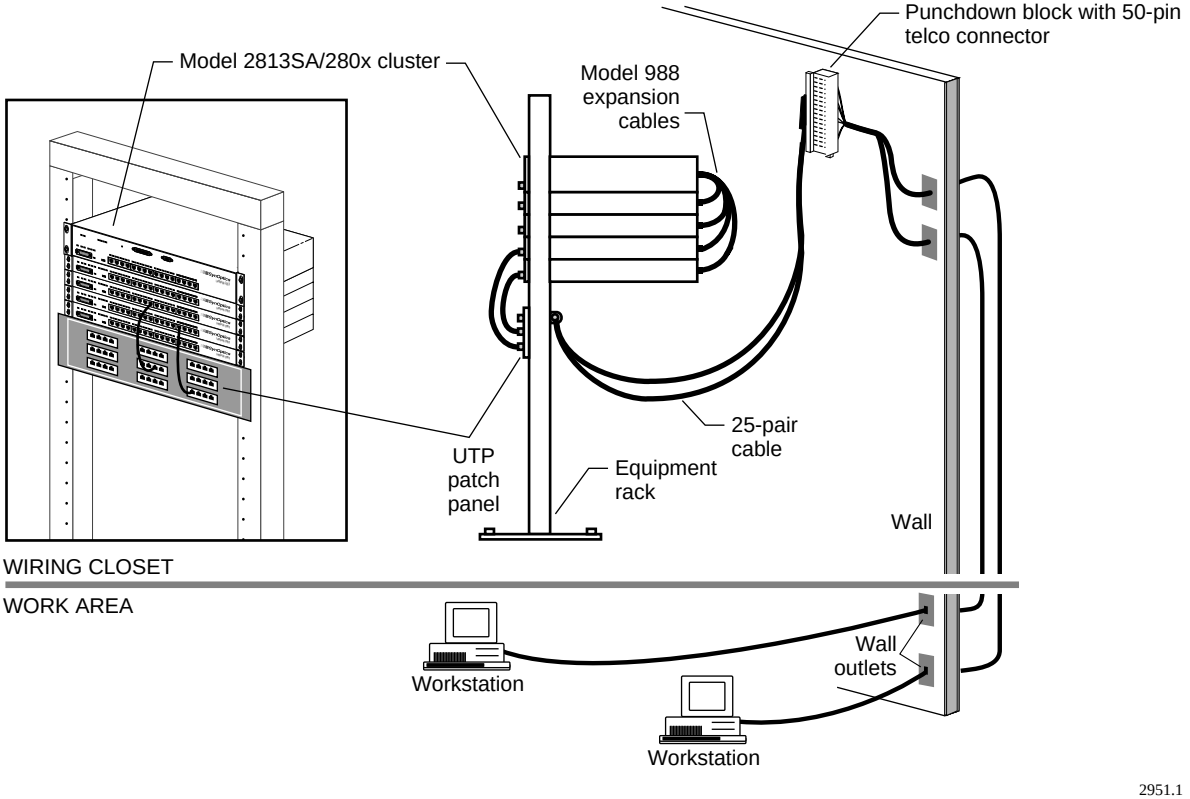


Figure 3-10. Typical Model 2813/2803 cluster configuration

Connection in a Model 281xSA/280x cluster is accomplished via Model 988 10BASE-T Workgroup Expansion Cables and the expansion ports on the hubs. The Model 281xSA hub extends full SNMP functionality to the ports on the Model 280x hub, providing up to 80 managed ports. Figure 3-10 shows a typical cluster configuration network with four Model 2803 hubs connected to the Model 2813SA.

NOTE: *A cluster configuration requires one (and only one) Model 281xSA hub, which supplies four expansion ports. These ports can be used to connect any combination of Model 2803 and 2804 hubs to the Model 281xSA hub. You cannot connect Model 280x hubs into a cluster without a Model 281xSA or Model 281x hub.*

Cluster Operation

A Model 281xSA/280x cluster configuration operates like a single-hub network, with these two additional conditions:

- Local hub management is disabled for any Model 280x hub connected to a Model 281xSA hub through the expansion port.
- Because of the nature of the expansion port connection, repeater functionality is distributed among all the units in the cluster, and the cluster becomes a single logical IEEE 802.3 Ethernet repeater.

If the Model 281xSA hub in a cluster loses power, the cluster configuration stops operating as a cluster. It loses the SNMP management, and the Model 280x hubs become isolated 16-port segments. If any one of the Model 280x hubs in a cluster loses power, the remaining hubs maintain the cluster configuration.

Connecting a Cluster Configuration

In the work area, connections to the network station are the same as those already described in the earlier section “Cable Connections in the Work Area.” Follow the appropriate steps for either STP or UTP cable.

To connect the cluster configuration, follow these steps:

1. **Connect the station cables to the hub host ports, as described earlier in “Ethernet Station Connections.”**

2. Connect the Model 280x hubs to the Model 281xSA hub, using the Model 988 Expansion Cable that was shipped with each Model 280x hub (see Figure 3-11).

a. Connect the DB-25 connector on one end of the expansion cable to the expansion port on the Model 280x hub.

b. Connect the other end of the expansion cable to an available expansion port on the Model 281xSA hub. At this point, if the hub power is on, one LED lights on each hub, as follows:

- The Expansion Status LED on the Model 281xSA hub lights.
- The associated Expansion LED on the Model 280x hub lights.

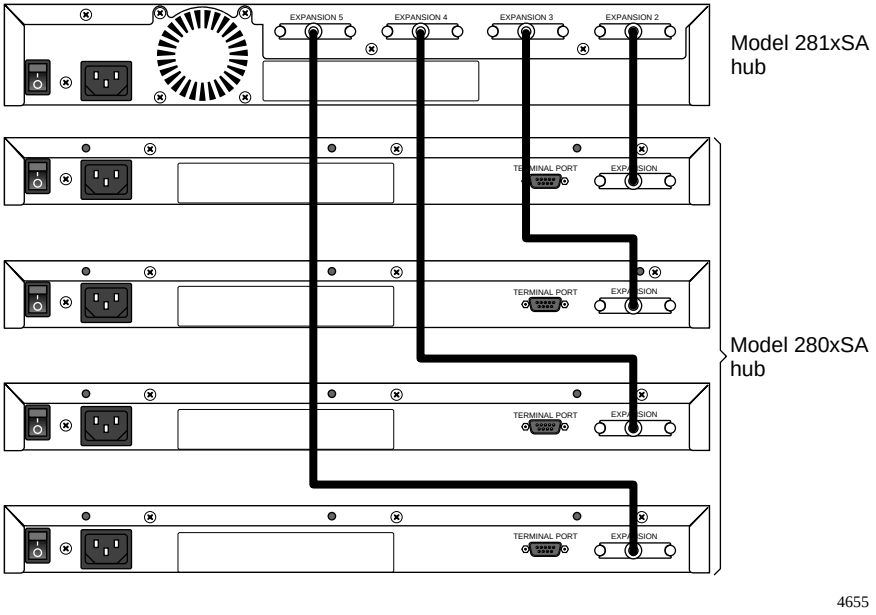


Figure 3-11. Connecting a cluster configuration

Multiple-hub Networks—System 2000 Only

Individual System 2000 hubs or Model 280x/281xSA cluster configurations can be interconnected through a backbone interconnection or through the MDI-X/MDI ports. Backbone connections are made through the interconnect port, either the AUI port (Model 2813SA hub) or the 10BASE-FL port (Model 2814SA hub).

Configuration Rules

When you install a network with more than one hub, you must follow these configuration rules:

- Make sure all UTP segments are no longer than 100 meters.
- Disable the signal quality error (SQE) test function on the transceiver connected to the AUI port of the Model 2813SA hub.
- You can have a maximum of four hubs (repeaters) in the data path between any two Ethernet stations. (Remember that a cluster counts as only a single repeater.) To extend the network further, use a bridge or router.
- To use port 1 as an interconnect port to an MDI-X port on another hub, you must configure it as an MDI port, using the MDI-X/MDI switch.

Interconnecting Model 2813SA Hubs Using the AUI Port

You can connect the AUI port on the Model 2813SA hub to any medium-specific IEEE 802.3 MAU. For example, you can use an IEEE 802.3 10BASE-FL fiber optic medium attachment unit (FOMAU), such as the SynOptics Model 504A transceiver, to connect the Model 2813SA hub to a fiber optic port on another hub. You can also connect the Model 2813SA hub AUI port to a coaxial backbone through an IEEE 802.3 MAU.

Although the example that follows shows connection between Model 2813SA hubs and fiber optic cable through transceivers, the simpler way to connect to a fiber backbone is by using Model 2814SA hubs, with their integral 10BASE-FL ports.

Connecting the AUI Port to a Fiber Backbone

Connecting an IEEE 802.3 10BASE-FL transceiver to the AUI port on the Model 2813SA hub allows you to connect the Model 2813SA hub to a fiber backbone. Figure 3-12 shows a typical network with two Model 2813SA hubs connected to a fiber backbone. An AUI patch cable connects each Model 2813SA hub to a SynOptics Model 504A transceiver that has the SQE test disabled. A fiber optic cable is connected between the two transceivers.

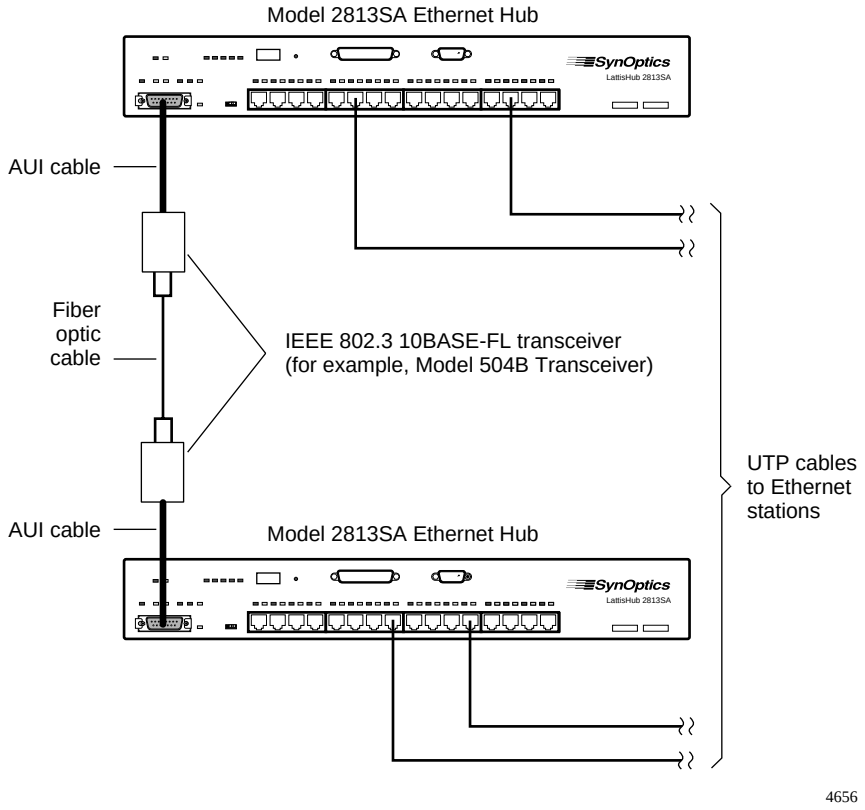


Figure 3-12. Interconnecting Model 2813SA hubs using an IEEE 802.3 10BASE-FL transceiver

To use an IEEE 802.3 10BASE-FL transceiver to interconnect the Model 2813SA hub and other hubs, follow these steps:

1. **Disable the SQE test on an IEEE 802.3 10BASE-FL transceiver (for example, a Model 504A transceiver).**

NOTE: *The IEEE 802.3 rules require you to disable the SQE test function on the IEEE 802.3 10BASE-FL transceiver connected to the AUI port of the Model 2813SA hub.*

2. **Connect an AUI cable between the AUI port on the Model 2813SA hub and the AUI port on the transceiver.**

3. **Connect a fiber optic cable between the transceiver and another optical port (for example, a port on a Model 3304A Host Module in a Model 3000 Concentrator) at the next higher level in the network hierarchy.**

Repeat steps 1 through 3 for each Model 2813SA hub that is to be interconnected through an IEEE 802.3 transceiver.

Connecting the AUI Port to Coaxial Backbone

You can use the AUI port to connect a Model 281xSA hub to a coaxial backbone through an IEEE 802.3 MAU. Figure 3-13 shows a Model 2813SA hub and a Model 2803/2813SA cluster connected to a coaxial backbone through IEEE 802.3 MAUs. An AUI cable is connected between the AUI port on each Model 28x3 hub and the MAU. The SQE test is disabled on each MAU connected to the AUI port on a Model 28x3 hub.

NOTE: *The IEEE 802.3 rules require you to disable the SQE test function on an IEEE 802.3 MAU connected to the AUI port of the Model 28x3 hub.*

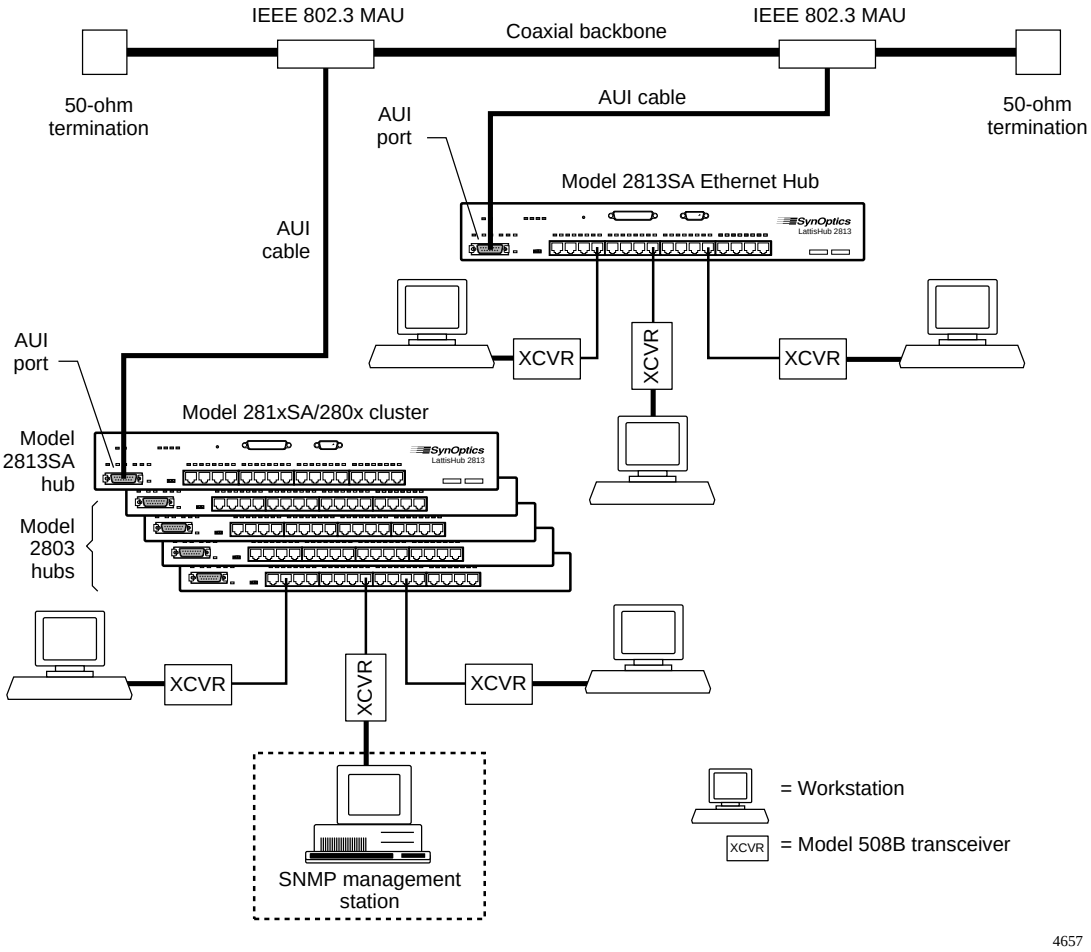


Figure 3-13. Interconnecting Model 281xSA hubs using coaxial backbone

To connect a Model 2813SA hub to a coaxial backbone, follow these steps:

1. **Disable the SQE test on the IEEE 802.3 MAU.**
2. **Connect the MAU to the coaxial backbone.**
3. **Connect an AUI cable between the IEEE 802.3 MAU and the AUI port on the Model 2813SA hub.**

Repeat steps 1 through 3 for each Model 2813SA hub that is to be connected to the coaxial backbone.

Interconnecting Model 2814SA Hubs Using the 10BASE-FL Port

Figure 3-14 shows two Model 2814SA hubs connected via their 10BASE-FL fiber ports. A fiber cable is connected directly between the ports on the two hubs; TX on each hub is connected to RX at the other end.

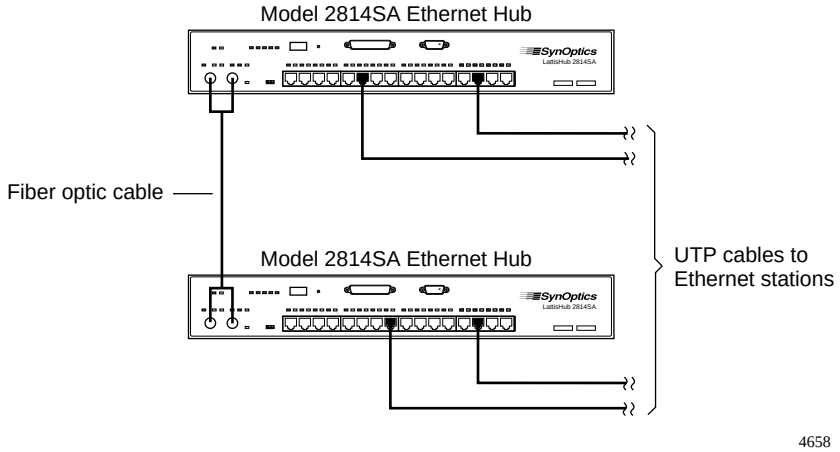


Figure 3-14. Connecting Model 2814SA hubs using the 10BASE-FL port

The fiber interface of the Model 2814SA hub is compatible with the latest IEEE 802.3 10BASE-FL draft standard, as well as fully compatible with the IEEE fiber optic inter-repeater link (FOIRL) standard. The fiber interconnect ports on the Model 2814SA hub support up to 2-kilometer distances using 62.5/125 μm core/cladding multimode optical fiber.

To connect two Model 2814SA hub 10BASE-FL ports, follow these steps:

1. **Make sure the power is on for both hubs.**
2. **Connect one end of a fiber cable to the ST connectors on one Model 2814SA hub 10BASE-FL port.**
3. **Connect the other end of the fiber cable to the other Model 2814SA hub 10BASE-FL port.**
4. **Check the Link LED for each port. If it is not lit, reverse the TX and RX connectors on one end of the cable.**

Interconnecting Hubs Using the MDI Port 1

You can interconnect Model 281xSA hubs by connecting an MDI port 1 on one Model 281xSA hub to any MDI-X 10BASE-T port on another hub. Figure 3-15 shows such a configuration, in which two Model 280x/2813SA clusters are connected to a Model 2813SA hub. Port 1 on each cluster Model 2813 hub is set to MDI, and a UTP patch cable is used to connect each of these ports to an MDI-X port on the higher Model 2813SA hub.

NOTE: *Interconnections through the MDI-X/MDI ports must always be from MDI to MDI-X. Ports 2 through 16 are internally configured as MDI-X ports, and the switchable port 1 is factory-set to be an MDI-X port. If you interconnect two Model 281xSA hubs through port 1 on both hubs, you must change one port (but only one) to the MDI setting.*

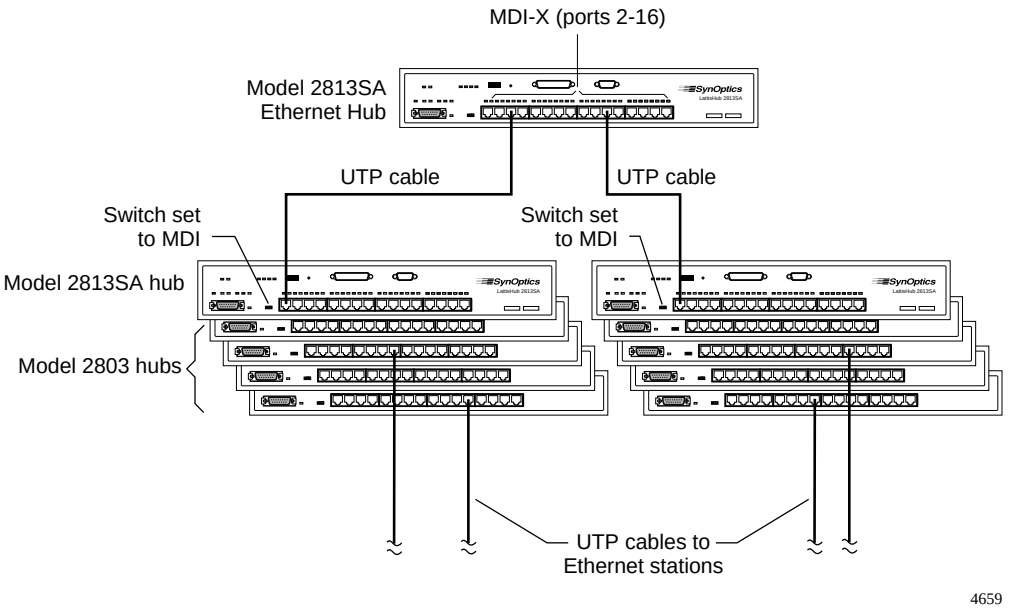


Figure 3-15. Interconnecting hubs via the MDI port

To use the MDI port 1 for interconnecting hubs, follow these steps:

1. **Use a small flat-blade screwdriver to set the MDI-X/MDI switch on a Model 281xSA hub to the MDI position (see Figure 3-16). This adjustment sets port 1 as an MDI port.**

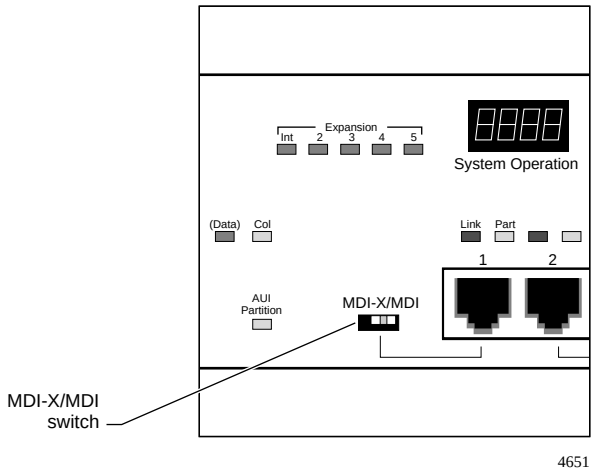


Figure 3-16. MDI-X/MDI switch set to MDI

2. Connect the MDI port 1 of the Model 281xSA hub to any MDI-X 10BASE-T port on a hub at the next higher level in the network hierarchy.

Repeat steps 1 and 2 for each Model 281xSA hub that is to be interconnected through an MDI port 1 to another hub.

Multiple-hub Networks—Including System 3000 Products

The Model 281xSA Ethernet Hubs readily interconnect with SynOptics System 3000 products, using the same cabling procedures already described. You can connect a Model 2813SA hub AUI port through a MAU or FOMAU to a host port on a System 3000 concentrator, or you can connect a Model 2814SA hub 10BASE-FL port directly to an optical port located in a System 3000 concentrator. For detailed information about networks using System 3000 equipment, see the *LattisNet System 3000 Ethernet Connectivity Guide*.

Figure 3-17 shows a typical network that combines a Model 3000 concentrator with a Model 281xSA hub and a Model 281xSA/280x cluster. Both the single hub and the cluster are connected to host ports on a Model 3304-ST Host Module in the Model 3000 concentrator.

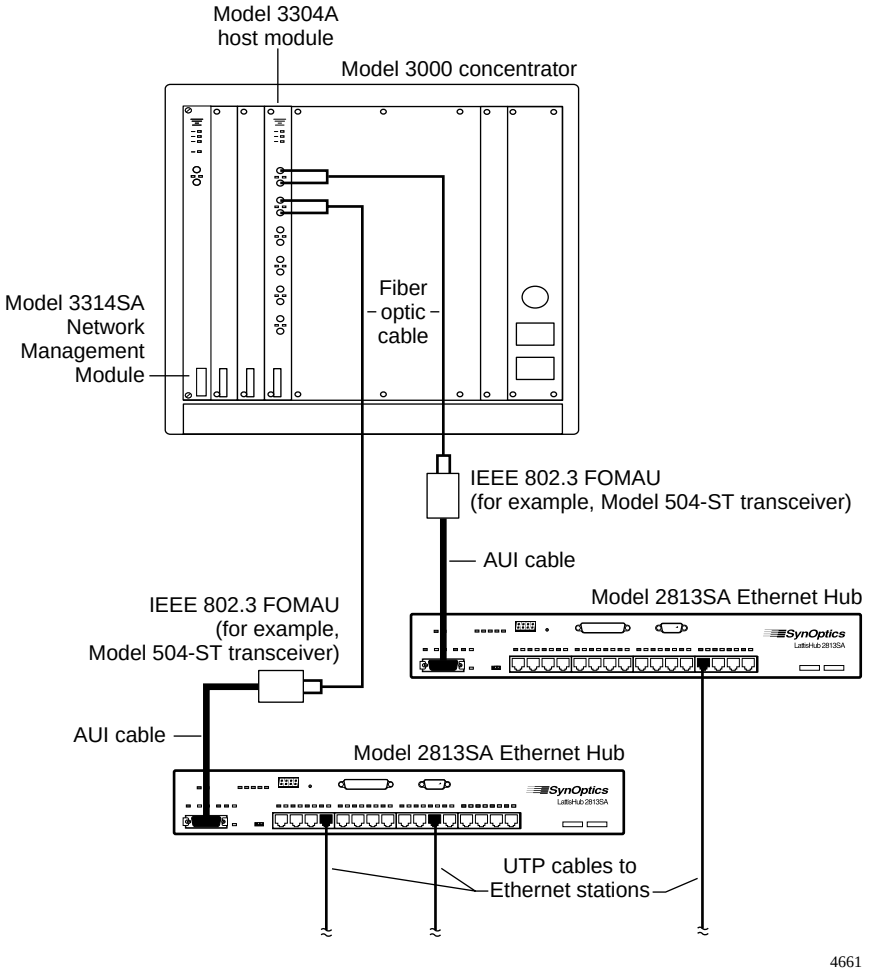


Figure 3-17. Network including a Model 3000 concentrator

You can also substitute a Model 281xSA/280x cluster for the Model 3000 concentrator shown in Figure 3-17. Figure 3-18 shows such a network in which a Model 2814SA/2804 cluster serves as the central point for the star-wired configuration. Clusters are interconnected through the fiber interconnect ports.

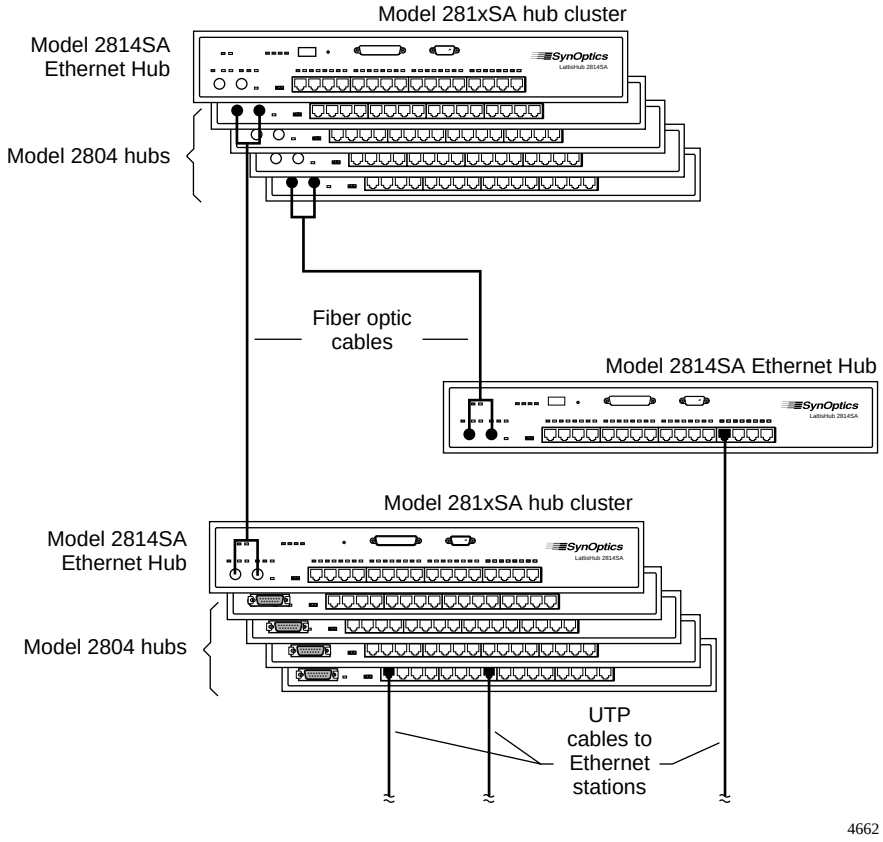


Figure 3-18. Fully manageable network composed entirely of Model 281xSA clusters and single hubs

Chapter 4 Configuring the Model 281xSA Hub for IP/IPX Networks

This chapter provides instructions for configuring the Model 2813SA and 2814SA Ethernet Hubs for networks that use IP, IPX, or a combination of the two.

Required Network Information and Configuration Actions

To manage the Model 281xSA hub in an IP or IPX network environment, you must have the hardware address of the Model 281xSA hub set up in the IP or IPX load server configuration file. The hardware address consists of 000081 followed by the number printed on the address label on the 281xSA front panel (see Figure 4-1). For instructions on setting up the configuration file, see Appendix G, "Setting Up the Model 281xSA Hub Configuration File," and refer to the documentation that shipped with your load server.

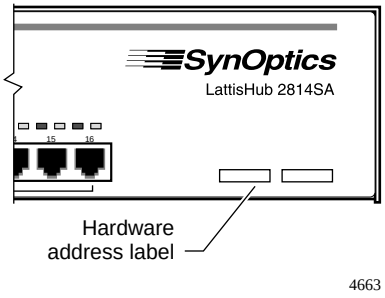


Figure 4-1. Hardware address label

On a network managed through IP network management (with or without IPX), the Model 281xSA hub requires a BootP server or requires configuration through the service port. The following sections explain IP and IPX configuration options. "Connecting to the Model 281xSA Service Port," later in this chapter, explains how to connect a suitable terminal to the Model 281xSA service port.

On a network managed exclusively through IPX network management, the Model 281xSA hub does not need a BootP server or service port configuration. The hub obtains the basic required IPX network information automatically from the other IPX entities on the network.

IP/IPX and BootP Network Configuration Options

The configuration process for the Model 281xSA hub depends on the network management protocol and on whether or not the network has an operating BootP server. The following four circumstances are typical:

- If the network is IP based and lacks a BootP server, you must configure the Model 281xSA hub through a terminal connected to the Model 281xSA service port. For instructions on configuring the Model 281xSA hub through the service port, see the section "Setting the Boot Configuration without a BootP Server" later in this chapter.
- If the network is IP based and has a BootP server, you do not need to configure the Model 281xSA hub through a terminal connected to the service port, provided that you first modify the load server configuration file, BOOTPTAB.TXT, and the Model 281xSA configuration file. The Model 281xSA configuration file should be installed on the load server as specified in the publications that came with load server or network management software. Text for the Model 281xSA configuration file and file parameter descriptions are given in Appendix G, "Setting Up the Model 281xSA Hub Configuration File."
- If the network is IPX based, you do not configure the Model 281xSA hub manually through the service port because the hub automatically obtains required IPX network information from the network.
- If the network uses both IP and IPX, you may need to configure the Model 281xSA hub for IP operation through the service port if no BootP server is operating on the network. For the IPX portion of the network, configuration through the service port is not necessary.

Using the Service Port

You can connect a terminal to the service port either before you turn on the power to the hub or while the hub is operating. Attaching a terminal allows you to view system startup diagnostics or to configure the hub.

When the Model 281xSA hub receives power, it runs self-test diagnostics and reports the results to the service port. If you have a standard RS-232 character terminal connected to the port (as explained in the following section), you can observe the diagnostic messages as the hub boots or goes through a reset.

Terminal Connection Requirements

To connect a terminal to the service port, you need the following two items:

- An ASCII character terminal that has an RS-232 serial port or a computer that has an RS-232 serial port and terminal emulation, typically a PC running common communications software
- A standard RS-232 serial communications cable with a DB-9 socket at one end for connection to the service port and an appropriate connector, usually a DB-9 or DB-25 plug, at the other end for connection to the serial port on the terminal or terminal emulator

Check the service port pin assignment in Appendix C, “Pin Assignments,” to ensure correct connections between the service port and the terminal.

Connecting to the Model 281xSA Service Port

To connect the terminal or terminal-emulating computer to the Model 281xSA service port, follow these steps:

1. **Connect the RS-232 cable DB-9 receptacle to the service port plug.**
2. **Connect the other end of the RS-232 cable to the terminal or terminal-emulating computer RS-232 serial port.**
3. **Turn on the power to the terminal or make sure the computer is running in terminal emulation mode.**
4. **Put the terminal (or emulator) into configuration mode and set the terminal parameters to the following settings:**

   9600 baud
   8 data bits
   No parity

1 stop bit
No handshaking
ASCII code

5. **Put the terminal (or emulator) online; do not leave it in configuration mode.**

   The terminal screen is ready to display the messages sent from the Model 281xSA service port, such as the results of the self-diagnostic tests that run automatically after the hub is reset or the power is turned on.

   To prepare the Model 281xSA hub for configuration or to view the service port messages from the Model 281xSA hub, perform the next step.

6. **Reset the hub or cycle the power to the Model 281xSA hub.**

   Watch the output display (see the next section) as the hub completes its self-test diagnostics.

Power-on Self-test Diagnostic Messages Display

The Model 281xSA hub performs a diagnostic self-test that checks its hardware components during system startup. With a terminal attached to the service port, diagnostic messages are displayed on the terminal screen (see Figure 4-2).

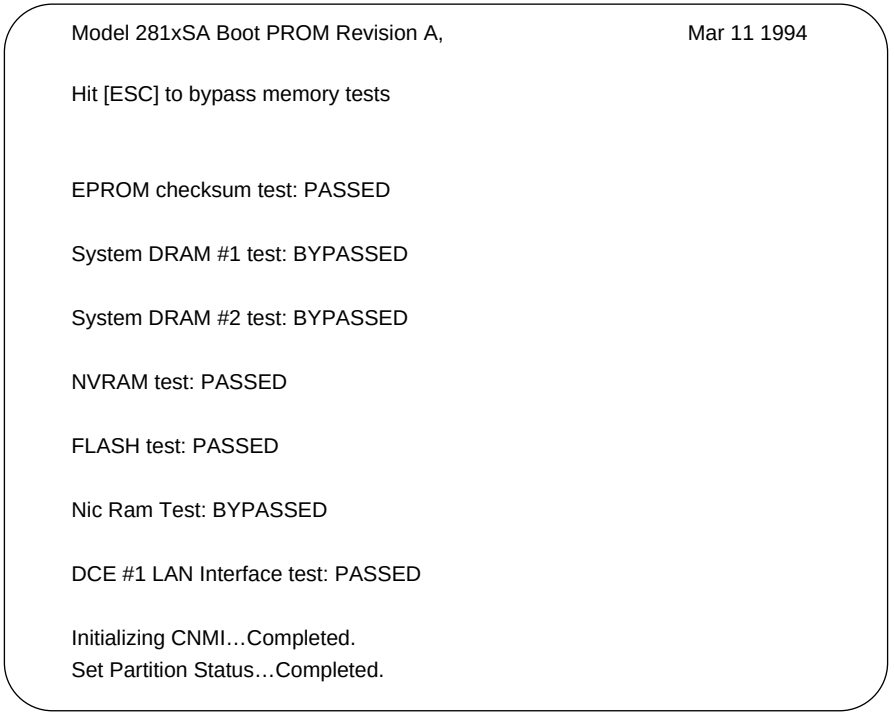


Figure 4-2. Diagnostic messages for the Model 281xSA hub

If an error occurs, the self-test loops to the point of the error. If the error persists, the Model 281xSA hub resets itself and restarts. If the same error message repeatedly displays on the monitor, or if the Fault LED remains lit, contact your supplier's customer service department.

If the error clears, the diagnostics continue and the hub LEDs light as follows:

- Power LED—on
- On Line LED—flashing
- NM Control—LED off
- Fault LED—off

After completing its diagnostics, the Model 281xSA hub continues automatically, trying to find the BootP server that has its configuration parameters. Figure 4-3 shows an example of the service port screen during a BootP sequence.

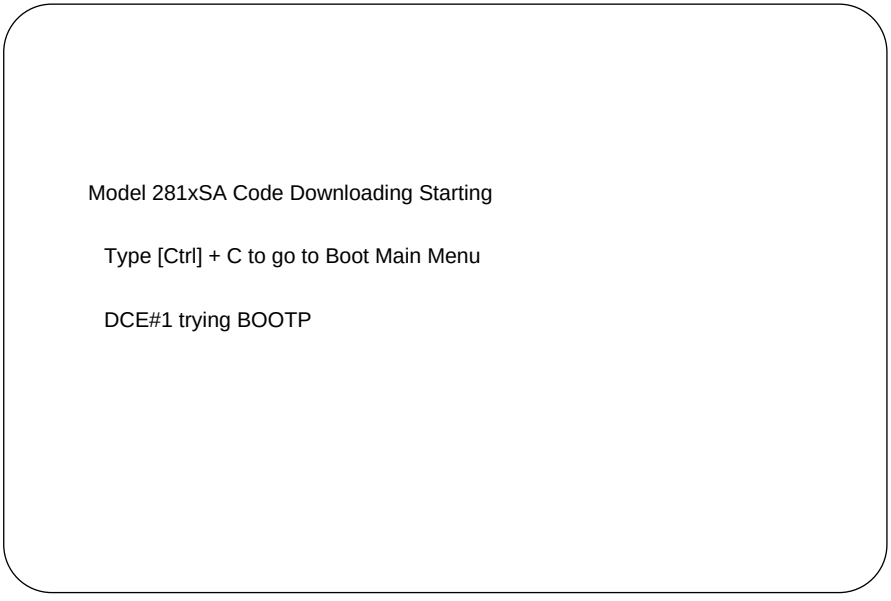


Figure 4-3. BootP service port screen display

To stop the automatic process and access the Model 281xSA boot configuration menus, press [Ctrl]+C. See “Setting the Boot Configuration without a BootP Server” later in this chapter.

Summary of the Boot Sequence with a BootP Server

This section summarizes the Model 281xSA hub boot sequence if a BootP server is present and the boot file, BOOTPTAB.TXT, and Model 281xSA configuration file, *281sa100.cfg*, are correctly configured on the load server. Given these conditions, you need not manually configure the Model 281xSA hub via the service port; the hub automatically obtains its IP configuration parameters via the BootP server and obtains its IPX parameters via the IPX file server.

The factory default settings for the Model 281xSA hub are:

- Boot Mode = Network
- Boot Protocol = Auto
- Image Load Mode = Remote w/Local
- Management protocol = IP_IPX
- Configuration load mode = Remote w/Local
- Read community = public
- Write community = private

The first time the Model 281xSA hub is powered on, it uses these settings to perform the following boot sequence:

1. The Model 281xSA hub performs a diagnostic self-test and displays the results on the terminal screen connected to the service port (if one is connected).
2. The screen connected to the service port displays the message:

   ```
   DCE#1 Trying BOOTP...
   ```

   while the Model 281xSA hub sends a broadcast message looking for its booting parameters.
3. The BootP server sends the booting parameters to the Model 281xSA hub.
4. If there is no response from the BootP server, the Model 281xSA hub issues IPX “Find Nearest Server” SAP (service access protocol) frames to learn the IPX network number. The connected screen displays:

   ```
   DCE#1 Trying SAP...
   ```

5. If a Novell server or IPX router is running on the network, it responds to the SAP request. If the SAP request is not answered, the Model 281xSA hub retries the BootP sequence.
6. Using ASCII mode TFTP, the server downloads the configuration file (as specified by the boot parameters) to the Model 281xSA hub DRAM.
7. Via binary mode TFTP, the server transfers the run-time image file (as specified by the configuration file or service port) to the Model 281xSA hub. The terminal screen (if connected to the service port) displays the SynOptics banner.
8. If the transferred code is different from that already in the flash EPROM, the new run-time code is saved into flash EPROM.
9. The Model 281xSA run-time image file begins execution. The green On Line LED of the Model 281xSA hub is on, and the yellow µP Fault LED is off, indicating normal operation.

NOTE: *If the downloaded image is different from what is already saved in flash EPROM, flash EPROM is updated after that remote download.*

Setting the Boot Configuration without a BootP Server

On some networks, a BootP server is not available to support the 281xSA SNMP network management agent or a configuration file other than the default configuration shown in Appendix G, “Setting Up the Model 281xSA Hub Configuration File.” If your Model 281xSA hub is connected to such a network and you use IP management, you must configure your Model 281xSA hub manually by using the service port. This section describes the Model 281xSA hub configuration and boot sequence, initial steps to make the hub ready for configuration, and the configuration menus and commands.

To configure the Model 281xSA hub through the service port, you use the configuration menus displayed on the terminal connected to the service port. The Boot main menu tells the hub how to identify itself to the network management software. You can access this menu only before the hub starts to load the image code, as explained in the following procedure.

To set the boot configuration, follow these steps:

1. **Connect a terminal to the hub service port, as described in "Connecting to the Model 281xSA Service Port" earlier in this chapter.**
2. **Turn on the power to the Model 281xSA hub; if it is already powered, press the Reset button on the front panel.**
3. **Press [Ctrl]+C while the hub is attempting its boot processes and the screen reads "DCE#1 trying BOOTP..." This allows you to access the Boot main menu (shown in Figure 4-4)**

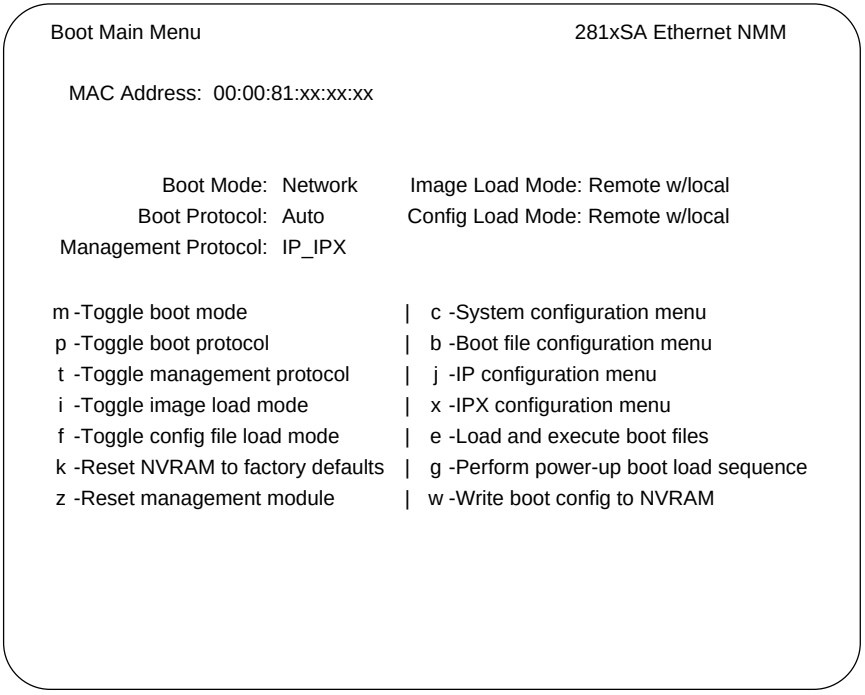


Figure 4-4. Boot main menu

4. **Set the hub IP network address, as follows:**
   a. Press j to display the IP Configuration menu.
   b. Press i to display the Set IP Address prompt.
   c. Enter the Model 281xSA hub IP address.

5. **Press [Esc] to return to the 281xSA Boot main menu.**
6. **Press f [Toggle config load mode] once to set the configuration load mode to Local.**
7. **Press m [Toggle boot mode] to set the boot mode to NVRAM.**
8. **Press i [Toggle image load mode] to set the image load mode to Local.**
9. **Press w [Write boot configuration to NVRAM] to save the booting parameters to NVRAM.**
10. **Press e [Load and execute boot files] to restart the hub.**

    As the hub goes through the booting process, messages are displayed on the screen, as shown in Figure 4-5 and Figure 4-6.

```
DCE#1 TFTP (NETASCII) to load the config file s281xsa.cfg
  Config file loaded
DCE#1 TFTP (OCTET) to load the image file s281xsa.img
  Image file loaded

Images in DRAM and FLASH are different. Begin writing image to FLASH
  Erasing FLASH …… Erased FLASH …
  Programming FLASH …

  Saved image to FLASH

      * * * * * * * * * * * * * * * * * * * * * *
      *  Copyright (c) 1994                       *
      *  SynOptics Communications, Inc.           *
      *  All Rights Reserved                      *
      *  Date: Mar 14 1994, Time: 17:38:02        *
      *  Model 281xSA Version 1.0.0               *
      * * * * * * * * * * * * * * * * * * * * * *
Press CTRL-Y to begin
```

4757

Figure 4-5. Boot messages (remote image file load)

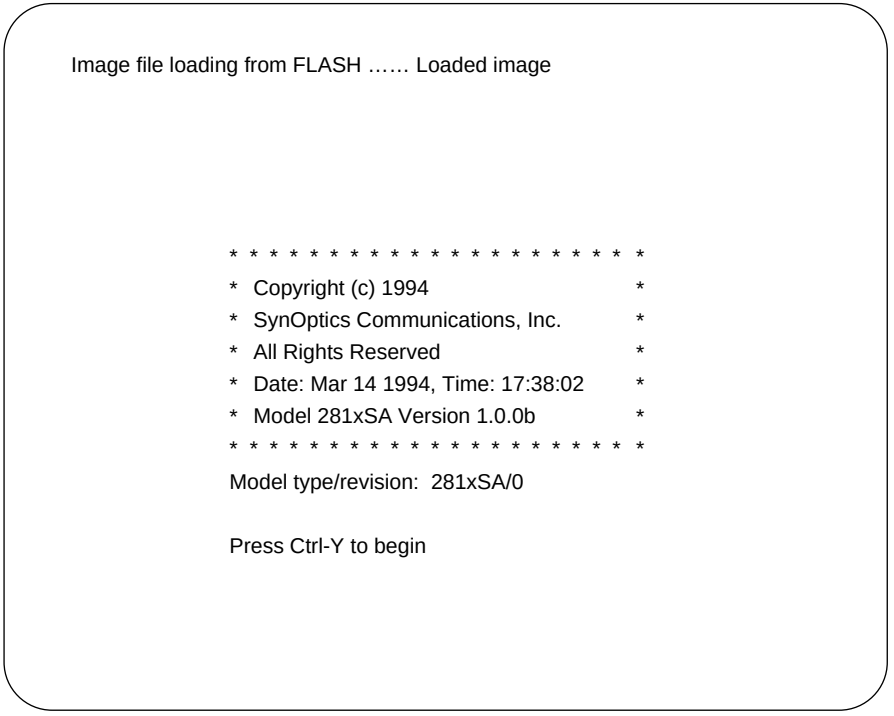


Figure 4-6. Boot messages (local image file load)

At this point, the Model 281xSA hub is completely operational and requires no user intervention. If you want to change any run-time parameters, press [Ctrl]+Y to display the run-time parameters menu. This menu and associated submenus are described in later sections of this chapter.

NOTE: *If you plan to manage your network only with IPX network management stations, BootP server or service port configuration is unnecessary. The Model 281xSA hub automatically obtains the required IPX network information from the network.*

Using Configuration Menus

To configure the Model 281xSA hub through the service port, you use configuration menus on the display of the terminal connected to the service port. There are two series of configuration menus:

- One menu series (see Figure 4-7) sets the primary boot configuration; that is, it tells the hub how to identify itself to the network management software. You can access this menu only before the image code is loaded. To access this menu, press [Ctr]+C.
- The other menu series (see Figure 4-8) modifies the run-time parameters; use the menus to change operating parameters as the hub is running. You can access these menus only after the image code is loaded. To access these menus, press [Ctr]+Y.

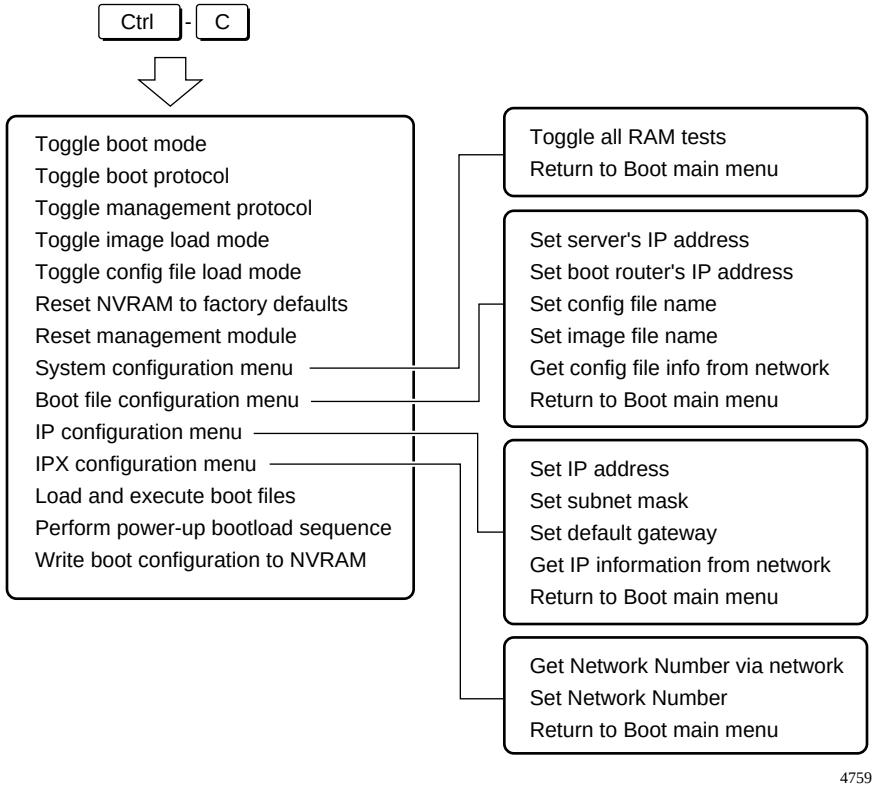


Figure 4-7. Primary boot configuration menus

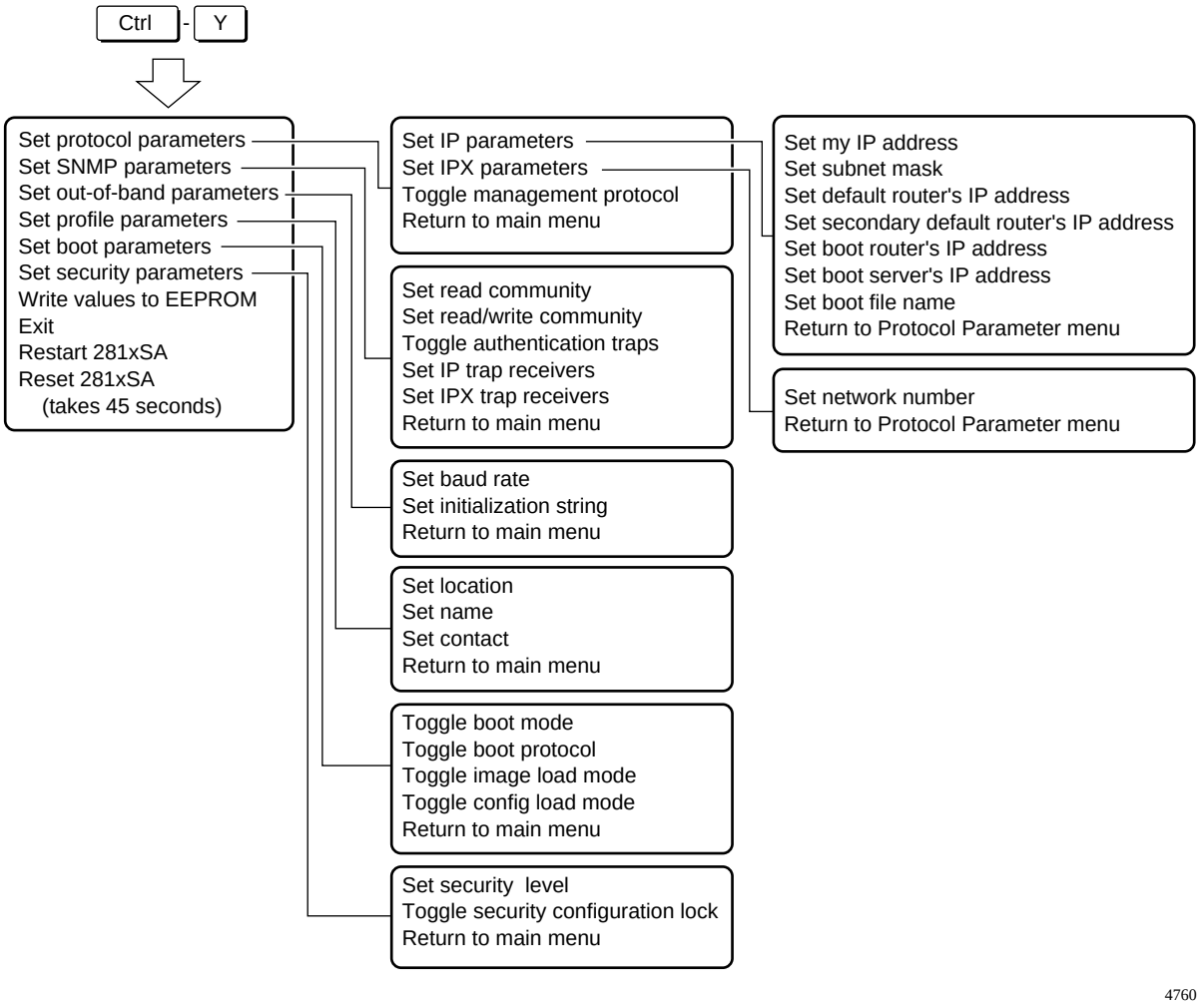


Figure 4-8. Run-time parameters menus

Menus for configuring the Model 281xSA hub have similar formats. Each menu shows the current settings for a group of parameters, followed by a list of commands for changing the parameters (see Figure 4-9 for an example).

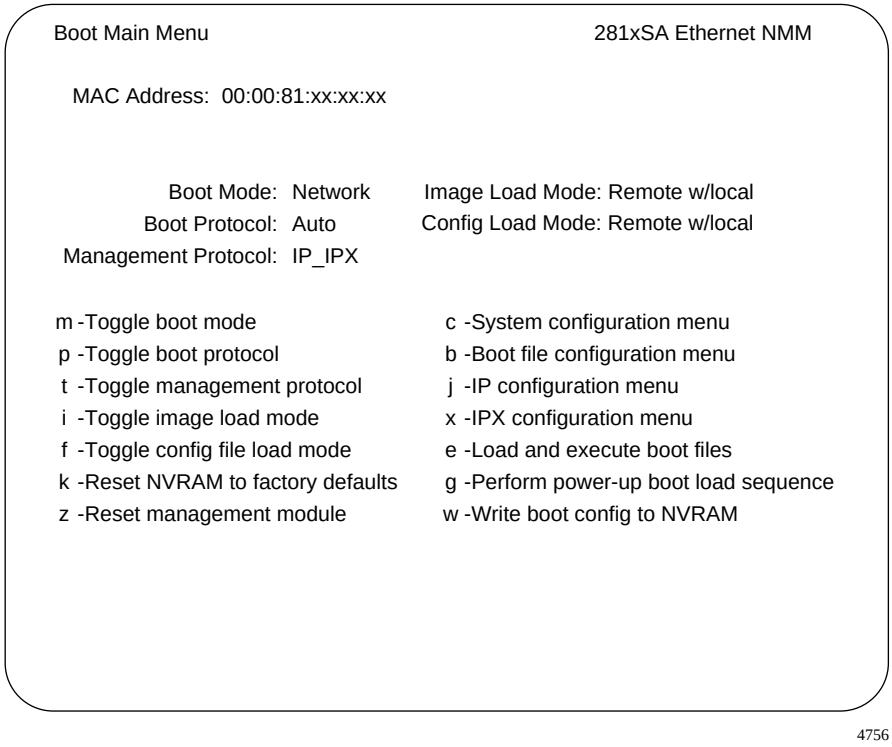


Figure 4-9. Sample configuration menu

Commands

Some commands switch between two or three possible settings; these commands toggle a condition. Other commands allow you to enter information; these commands set, add, or delete a parameter value. Specific commands on the main menu shift the display to other menus from which you can select additional commands.

To use the menus, follow these steps:

1. **Press the key for the letter of the command you want to issue.**

   If you select a toggle command, the specified parameter changes its setting in the upper part of the menu.

If you select a set, add, or delete command, either the display shifts to a submenu or the command you selected displays at the bottom of the menu, followed by a type-in field. When a command selection displays a type-in field, enter the requested information.

2. **Repeat step 1 if you want to change other parameters.**
3. **If you are working from a submenu, press [Esc] when you are finished. If you are working from the main menu, choose an appropriate command from the command list.**

Boot Configuration Menus

To set the primary boot configuration without a BootP server, press [Ctrl]+C during the boot process to display the menu shown in Figure 4-10.

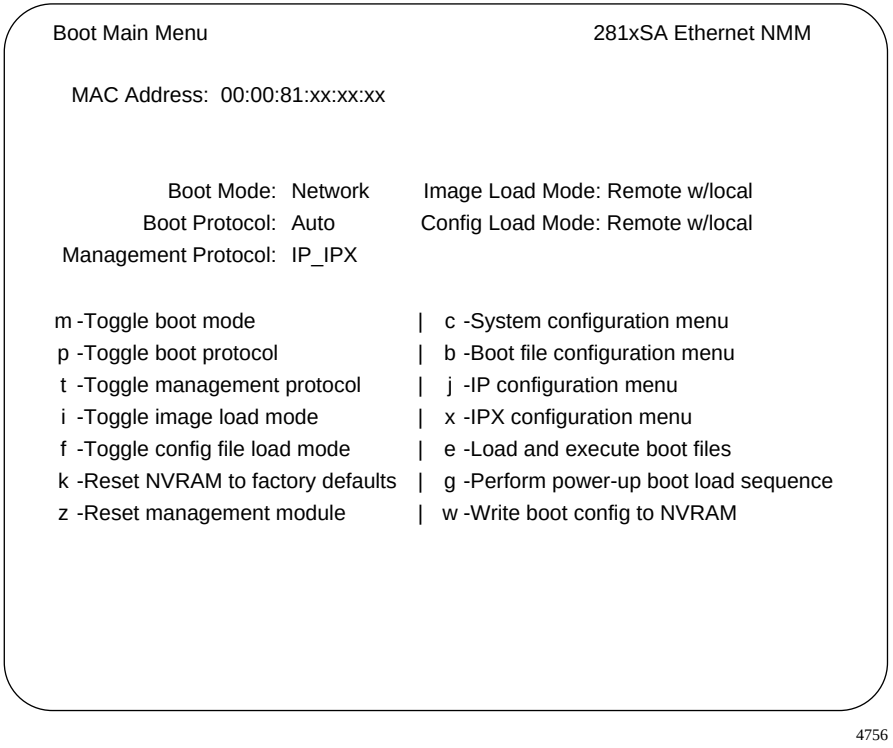


Figure 4-10. Boot main menu

The commands in this menu are of four types:

- The m, p, t, i, and f commands set values for the parameters at the top of the menu.
- The j and x commands open submenus that configure the IP and IPX operating parameters.
- The k, z, e, g, and w commands initiate an action by the Model 281xSA hub.
- The c and b commands open submenus to configure the Model 281xSA hub for booting.

To change a parameter value in the top section of the menu, type the letter that corresponds to the parameter you want to change. Then type the new entry for that item. To initiate one of the actions, simply type the letter of the desired command.

See "Boot Configuration Commands" for a complete description of all the boot configuration commands on the Boot main menu.

Boot Configuration Commands

The Boot main menu includes the following commands:

m **[Toggle boot mode]** Shifts the boot mode between Network and NVRAM. The factory default setting is Network.

When Network is selected, the Model 281xSA hub tries to acquire its configuration over the network, using the protocol specified by the p command [Toggle boot protocol].

When NVRAM is selected, the Model 281xSA hub configures itself during power-on or reset using the parameter values obtained from the NVRAM (if they exist).

NOTE: *When* NVRAM *is selected as the boot mode, you must use the menu selections to set or change the required parameters.*

p **[Toggle boot protocol]** Shifts the boot protocol among Auto, IP, IPX, and IP_IPX. The factory default setting is Auto.

NOTE: *If m [Toggle boot mode] is set to NVRAM, this parameter is ignored.*

When Auto is selected, the Model 281xSA hub tries to find its IP or IPX configuration parameters over the network. This process has two stages:

- First the Model 281xSA hub seeks the IP parameters and configuration file from a BootP server, transfers the configuration file, and writes the values (if it finds them) into NVRAM. (Without IP parameters stored in NVRAM, this Model 281xSA hub cannot be managed by IP.)
- Then the Model 281xSA hub seeks the IPX parameters and configuration file from a Novell server and writes the values into NVRAM.

As long as it can find either IP or IPX parameters, the Model 281xSA hub writes the values into NVRAM. If the Model 281xSA hub fails to locate either an IP BootP server or a Novell (IPX) server or router, it resets and starts over.

When IP is selected, the Model 281xSA hub tries to locate a BootP server and load the IP parameter values. It also writes these values into NVRAM. If it cannot find a BootP server or transfer the configuration file, it times out and returns to the Boot main menu without obtaining a network address. If IP is selected, the Model 281xSA hub does not look for IPX parameters.

When IPX is selected, the Model 281xSA hub looks for a Novell server or router from which it can obtain the IPX network number. If no server or router responds, the Model 281xSA hub returns to the Boot main menu. When IPX is selected, the Model 281xSA hub does not look for a BootP server.

When IP_IPX is selected, the Model 281xSA hub looks for *both* a BootP server (to provide the IP parameters) *and* a Novell server or router (to provide the IPX parameters). First the Model 281xSA hub looks for a BootP server. If it finds a BootP server, the hub

downloads the configuration file without continuing to seek an IPX address. If the hub cannot find a BootP server, it looks for a Novell server or router. If it finds one, it transfers the configuration file, obtains the IPX network number, and writes the parameter values into NVRAM. If it fails to find IP parameters, the Model 281xSA hub resets itself and starts the booting process over.

t **[Toggle management protocol]** Shifts the management protocol among IP_IPX, IP, and IPX**.** The factory default setting is IP_IPX. The management protocol is independent of the boot protocol.

When IP_IPX is selected, the Model 281xSA hub can be managed by either IP or IPX network management stations.

When IP is selected, the Model 281xSA hub can be managed only by IP network management stations.

When IPX is selected, the Model 281xSA hub can be managed only by IPX network management stations.

NOTE: *The Model 281xSA hub must have a valid configuration in NVRAM for the protocol the network management station is using. That is, the Model 281xSA hub must know its IP address and proper subnet mask if an IP network management station is used to manage it. Likewise, the Model 281xSA hub must know its IPX network number if an IPX network management station is used.*

i **[Toggle image load mode]** Shifts the image load mode among Remote, Remote w/Local, and Local. The factory default setting is Remote w/Local.

When Remote is selected, the image file is never loaded from local flash EPROM, even if downloading fails and the local image file exists.

When Remote w/Local is selected, the local image is used as a backup in case the remote download fails. If the download fails, instead of resetting itself and starting the process over, the Model 281xSA hub loads the image file from local flash EPROM.

When Local is selected, the Model 281xSA hub loads the image file from onboard local flash EPROM.

NOTE: *When the image load mode is set to Local, local loading of the image file will not be performed if the Model 281xSA hub has neither an IPX nor an IP address.*

If the local image file is corrupted, you are not allowed to set the image load mode to Local.

f **[Toggle config file load mode]** Shifts the configuration file load mode among Remote, Local, and Remote w/Local.

When Remote is selected, the configuration file is loaded from the network via TFTP, as described for command i [Toggle image load mode].

When Local is selected, the configuration file data is loaded from NVRAM.

When Remote w/Local is selected, the Model 281xSA hub attempts to load the configuration file from the network, as described for the i command [Toggle image load mode]. If the remote load is not successful, the Model 281xSA hub loads the configuration file data from NVRAM.

k **[Reset NVRAM to factory defaults]** Restores all menu settings and NVRAM data to the original values set at the factory.

z **[Reset management module]** This command causes the Model 281xSA hub to go through the self-test and image loading process. Before the command takes effect, a confirmation message appears on the screen.

c **[System configuration menu]** Shifts the display to another menu that allows you to enable or disable RAM tests when the Model 281xSA hub starts up.

b **[Boot file configuration menu]** Shifts the display to another menu that allows you to set or modify the boot server address, default boot router address, and the configuration and image filenames.

j **[IP configuration menu]** Shifts display to another menu (see the next section, "IP Configuration Menu") that allows you to set or modify the Model 281xSA hub IP address, subnet mask, and default gateway.

x **[IPX configuration menu]** Shifts display to another menu (see the later section "IPX Configuration Menu") that allows you to set or modify the Model 281xSA hub IPX network number.

e **[Load and execute boot files]** Directs the Model 281xSA hub to try to load the configuration specified by the parameter values shown on the menu and begin operation.

If the image load mode is set to Remote or Remote w/Local, this command can be used to interactively test the operation of your TFTP server. If the parameters are set correctly, a series of boot messages display, as shown in Figure 4-5. If the image load mode is set to Local, this command loads the local flash EPROM image file and begins execution. A series of boot messages displays, as shown in Figure 4-6.

w **[Write boot config to NVRAM]** Takes all the parameters that you have set using the configuration menus and stores them in NVRAM.

g **[Perform power-up boot load sequence]** Reboots the Model 281xSA hub without going through a hardware reset. This command starts the hub, using the appropriate values for boot mode, image load mode, configuration load mode, and boot protocol.

System Configuration Menu

When you select the c command [System configuration menu] from the Boot main menu, the menu in Figure 4-11 is displayed.

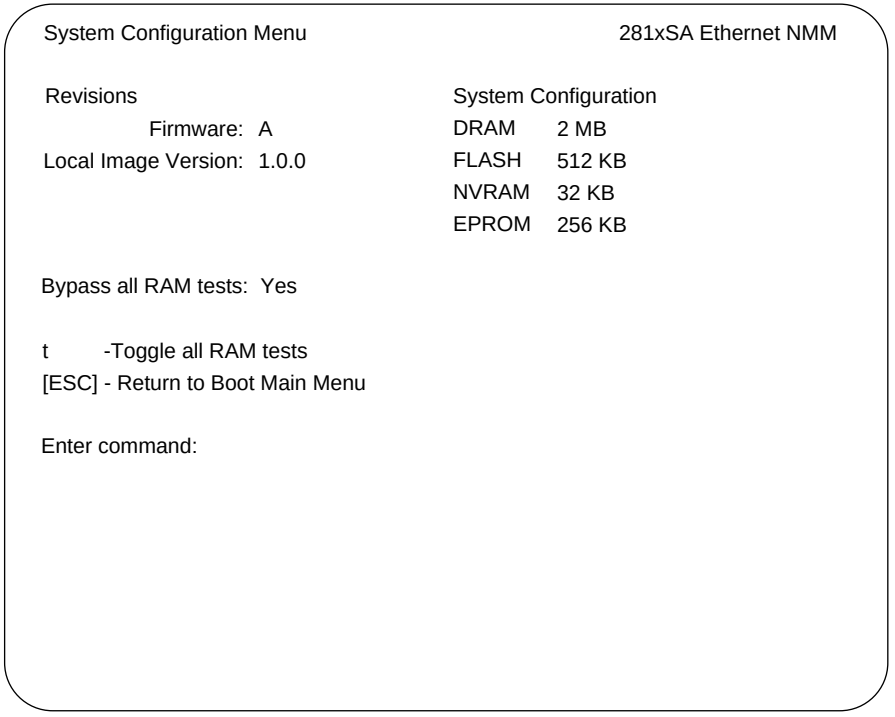


Figure 4-11. System Configuration menu

This menu shows the current firmware and image file version numbers and the system memory configuration. The command on this menu allows you to enable or disable the DRAM self-tests when the hub is powered up. These tests can last for more than 15 minutes, depending on memory size. Bypassing the tests speeds up the powerup sequence. However, if you enable the self-tests, you are more likely to discover any memory problems immediately, rather than trying to diagnose obscure run-time errors later.

This menu includes the following commands:

t **[Toggle all RAM tests]** Enables or disables the DRAM self-tests when you power up the hub.

[Esc] **[Return to Boot Main Menu]** Returns the display to the Boot main menu.

Boot File Configuration Menu

When you select the b command [Boot file configuration menu] from the Boot main menu, the menu in Figure 4-12 is displayed.

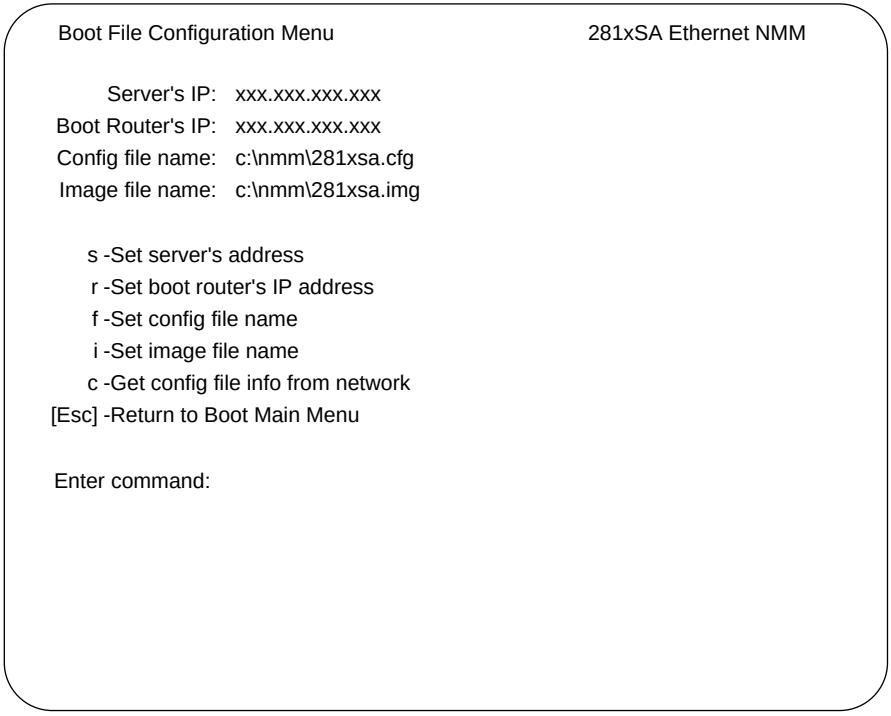


Figure 4-12. Boot File Configuration menu

This menu allows you to set up the configuration data for downloading remote configuration and image files from a server.

This menu includes the following commands:

s **[Set server's IP address]** Use this command to enter the network IP address of the BootP server. The address can be up to 12 numeric characters, written in dotted-decimal notation (N.N.N.N, with N being a value from 0 to 255, inclusive). To set this address to [none], enter 0.0.0.0 or type [none]. See Appendix F, "IP Addressing," for a description of what each part of the address means.

r **[Set boot router's IP address]** Use this command to enter the network IP address of the boot router. The address can be up to 12 numeric characters, written in dotted-decimal notation. To set this address to [none], enter 0.0.0.0 or type [none]. See Appendix F, "IP Addressing," for a description of what each part of the address means.

f **[Set config file name]** Use this command to enter a filename or full pathname for the configuration file. The filename can be up to 64 visible characters, including embedded punctuation and white space. This filename is used verbatim in the TFTP open packet. The default filename is [none].

i **[Set image file name]** Use this command to enter a filename or full pathname for the image file. The filename can be up to 64 visible characters, including embedded punctuation and white space. This filename is used verbatim in the TFTP open packet. The default filename is [none].

NOTE: *If the config load mode is Remote or Remote w/Local, this entry is overwritten by the image filename that is part of the configuration file.*

c **[Get config file info from network]** This command allows you to perform a BootP sequence without actually booting up the Model 281xSA hub.

[Esc] **[Return to Boot Main Menu]** Returns the display to the Boot main menu.

IP Configuration Menu

When you select the j command [IP configuration menu] from the Boot main menu, the menu in Figure 4-13 is displayed.

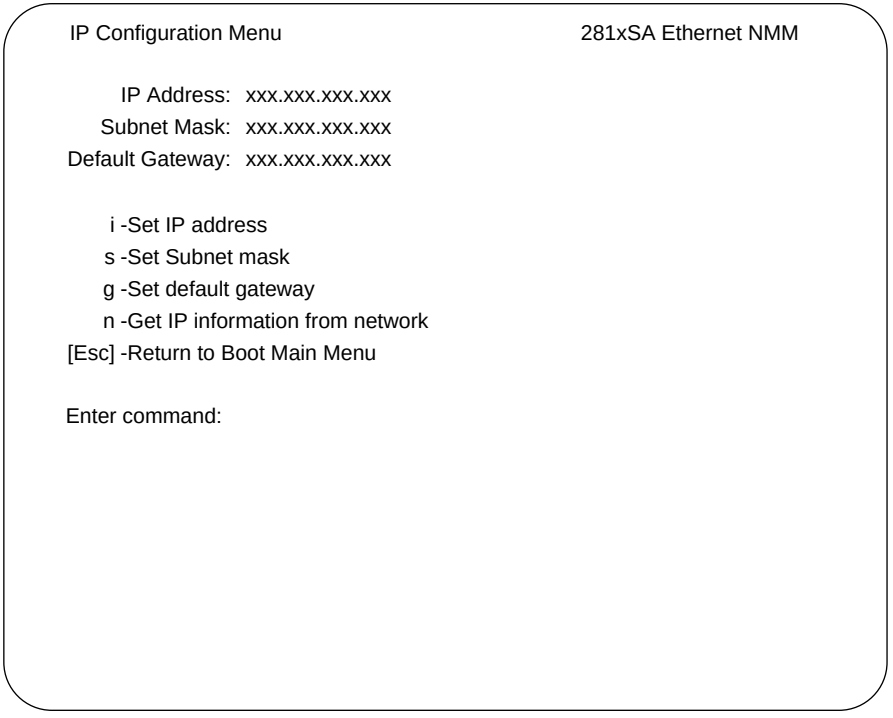


Figure 4-13. IP Configuration menu

The new settings must be written to NVRAM (using the w command [Write boot config to NVRAM] on the Boot main menu) in order for them to take effect.

This menu includes the following commands:

i **[Set IP address]** Use this command to identify the network IP address of the Model 281xSA hub. The address can be up to 12 numeric characters, written in dotted-decimal notation. This is the Internet address the hub uses during operation. To set this address to [none], enter 0.0.0.0 or type [none]. See Appendix F, "IP Addressing," for a description of what each part of the address means.

s **[Set Subnet mask]** Use this command to identify the subnet mask of the Model 281xSA hub. The subnet mask can be up to 12 numeric characters, written in dotted-decimal notation. This is the Internet subnet mask the hub uses during operation. To set this subnet mask to [none], enter 0.0.0.0 or type [none]. The default mask is 255.255.255.0. See Appendix F, "IP Addressing," for a description of subnet masks.

g **[Set default gateway]** Use this command to set the default gateway address of the Model 281xSA hub. The default gateway address can be up to 12 numeric characters, written in dotted-decimal notation. This is the default gateway the hub uses during operation. To set this default gateway to [none], enter 0.0.0.0 or type [none].

n **[Get IP information from network]** Use this command to perform a BootP sequence without actually booting up the Model 281xSA hub.

[Esc] **[Return to Boot Main Menu]** Returns the display to the Boot main menu.

IPX Configuration Menu

When you select the x command [IPX configuration menu] from the Boot main menu, the menu in Figure 4-14 is displayed.

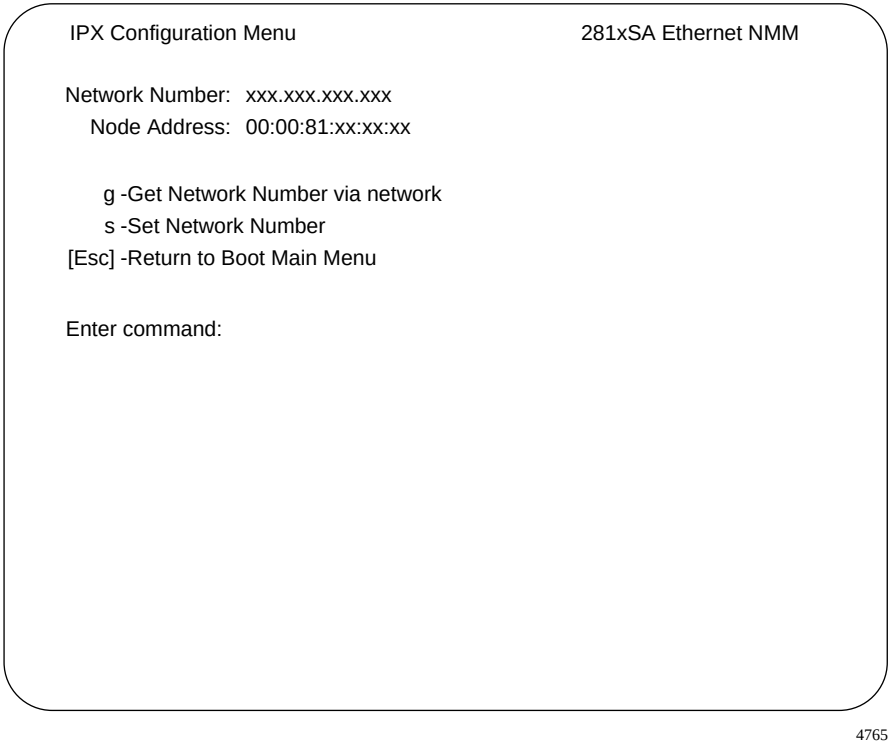


Figure 4-14. IPX Configuration menu

For the new settings to take effect, they must be written to NVRAM (using the w command [Write boot config to NVRAM] on the Boot main menu).

This menu includes the following commands:

g **[Get network number via network]** Causes the Model 281xSA hub to issue IPX “Find Nearest Server” SAP broadcasts to learn the local network number.

s **[Set network number]** Eight numeric characters, identifying the IPX network number the Model 281xSA hub is attached to. This is the network number the hub uses during operation. To set this number to [none], enter 00000000.

[Esc] **[Return to Boot Main Menu]** Returns the display to the Boot main menu.

Setting Run-time Parameters

When the boot sequence is complete and the image code is running, the Model 281xSA hub requires no further user intervention. However, if you want to modify run-time parameters, type [Ctr]+Y to display the menu shown in Figure 4-15. Using this menu, you can perform the following tasks:

- Update IP and IPX configuration parameters or boot parameters
- Set the Model 281xSA hub for out-of-band operation
- Set SNMP parameters
- Set the location string for the Model 281xSA hub

If you change any of these settings, you must store the new settings in NVRAM (the w command) and either restart or reset the Model 281xSA hub (the r or z command) in order for the new settings to take effect.

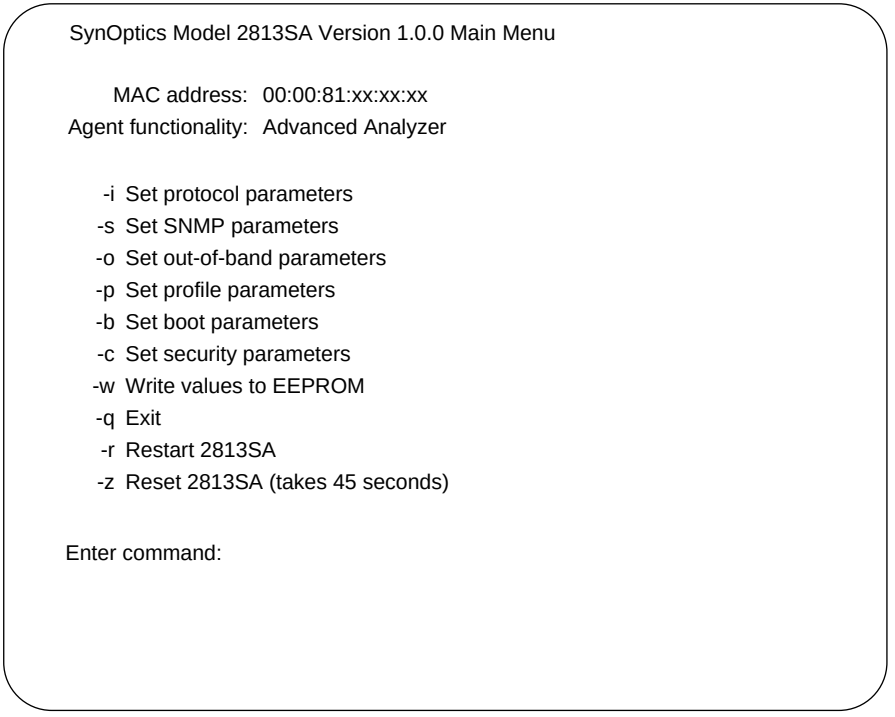


Figure 4-15. Menu for changing run-time parameters

The first six commands (i, s, o, p, b, and c) display menus with specific commands for each set of parameters. The menus for these commands are described in the next six sections. The other commands produce results without shifting to other menus.

This menu includes the following commands:

i **[Set protocol parameters]** Displays another menu that allows you to set or modify the IP or IPX configuration parameters and set the management protocol.

s **[Set SNMP parameters]** Displays another menu that allows you to set or modify the SNMP read community and read/write community, to enable or disable the authentication traps, and to set IP and IPX trap receivers.

o **[Set out-of-band parameters]** Displays another menu that allows you to set or modify the initialization string and baud rate.

p **[Set profile parameters]** Displays another menu that allows you to set or modify the location, name, and administrator contact strings.

b **[Set boot parameters]** Displays another menu that allows you to set or modify the boot mode, boot protocol, and image load mode.

c **[Set security parameters]** Displays another menu that allows you to enable or disable security features and to toggle the security configuration lock.

w **[Write values to EEPROM]** Saves the current parameter values (including any you have just changed) to the NVRAM. When the Model 281xSA hub is restarted, it uses these values during booting.

q **[Exit]** Takes you out of the configuration process without saving any changed values.

r **[Restart 281xSA]** Reexecutes the code that is already downloaded, using new parameter values if they were saved to EEPROM. When you issue this command, a screen message asks for confirmation. Upon confirmation, the screen immediately scrolls to the SynOptics banner and displays the message "Press CTRL-Y to begin."

z **[Reset 281xSA]** Resets the unit. This command causes the Model 281xSA hub to go through self-tests and the image-loading process again.

Protocol Parameters Menu

When you select the i command [Set protocol parameters] from the run-time parameters menu, the menu in Figure 4-16 is displayed.

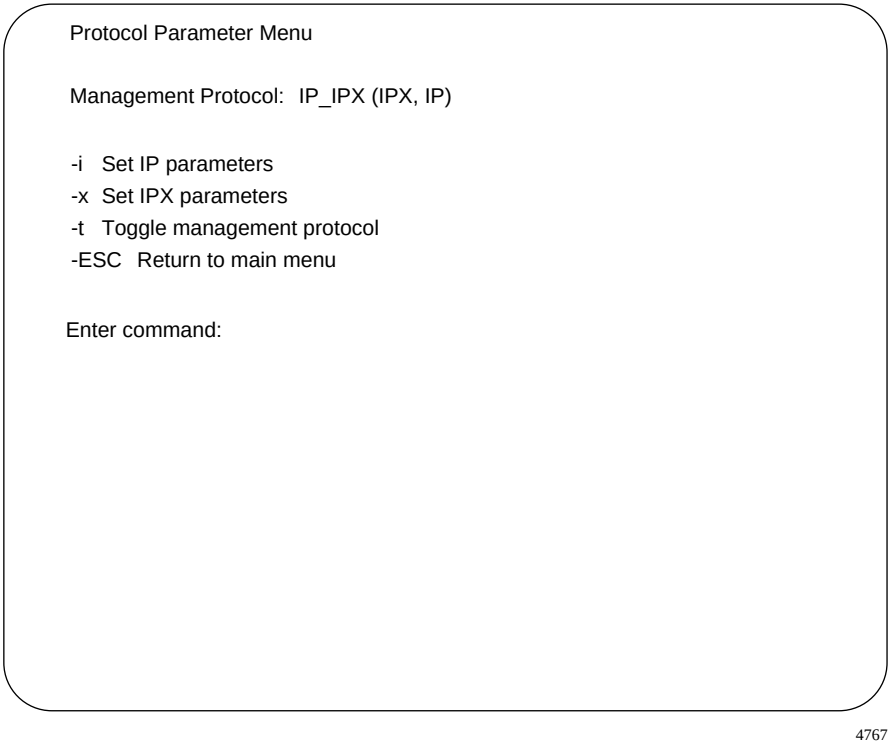


Figure 4-16. Protocol Parameters menu

This menu includes the following commands:

i **[Set IP parameters]** Displays another menu that allows you to set or modify the hub IP address, subnet mask, default router IP address, boot server IP address, and boot filename.

x **[Set IPX parameters]** Displays another menu that allows you to set or modify the IPX network number.

t **[Toggle management protocol]** Switches the management protocol among IP, IPX, and IP_IPX. The factory default setting is IP_IPX.

When IP_IPX is selected, the Model 281xSA hub can be managed by either IP or IPX network management stations.

When IP is selected, the Model 281xSA hub can be managed only by IP network management stations.

When IPX is selected, the Model 281xSA hub can be managed only by IPX network management stations.

NOTE: *The Model 281xSA hub must have a valid configuration for the protocol the management station is using. That is, the Model 281xSA hub must know its IP address and proper subnet mask if an IP management station is used to manage it. Likewise, the Model 281xSA hub must know its IPX network number if an IPX management station is used.*

ESC **[Return to main menu]** Returns the display to the main menu.

IP Parameters Menu

When you select the i command [Set IP parameters] from the Protocol Parameters menu, the menu in Figure 4-17 is displayed.

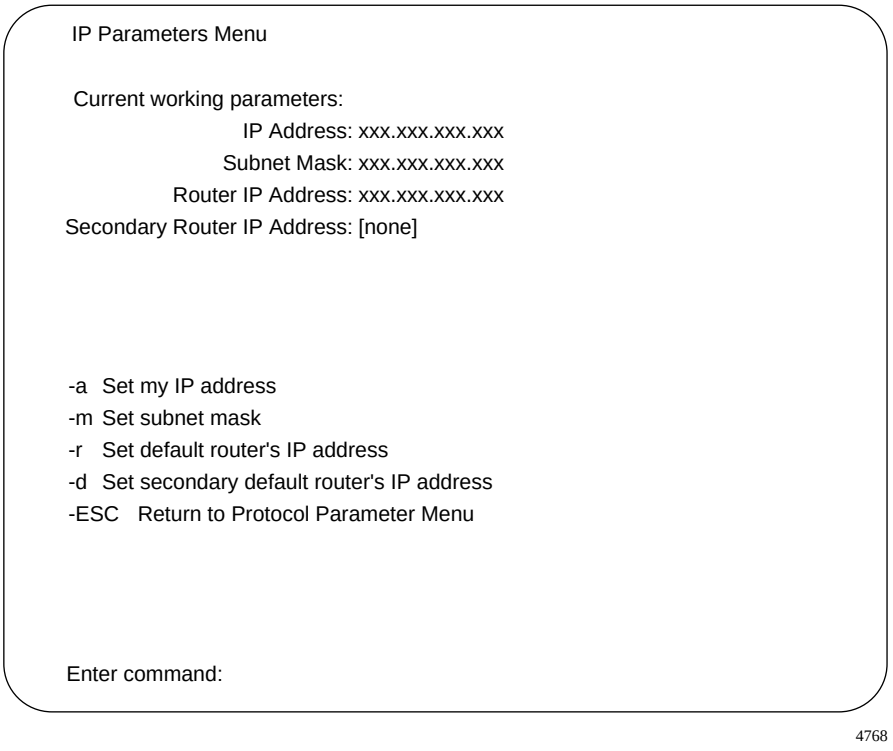


Figure 4-17. IP Parameters menu

When you modify run-time parameters on this menu, the screen changes to show both the original settings and the new ones (see Figure 4-18). The new settings will take effect only after you exit the configuration program and save them to NVRAM (using the w command on the main menu), then restart or reset the Model 281xSA hub.

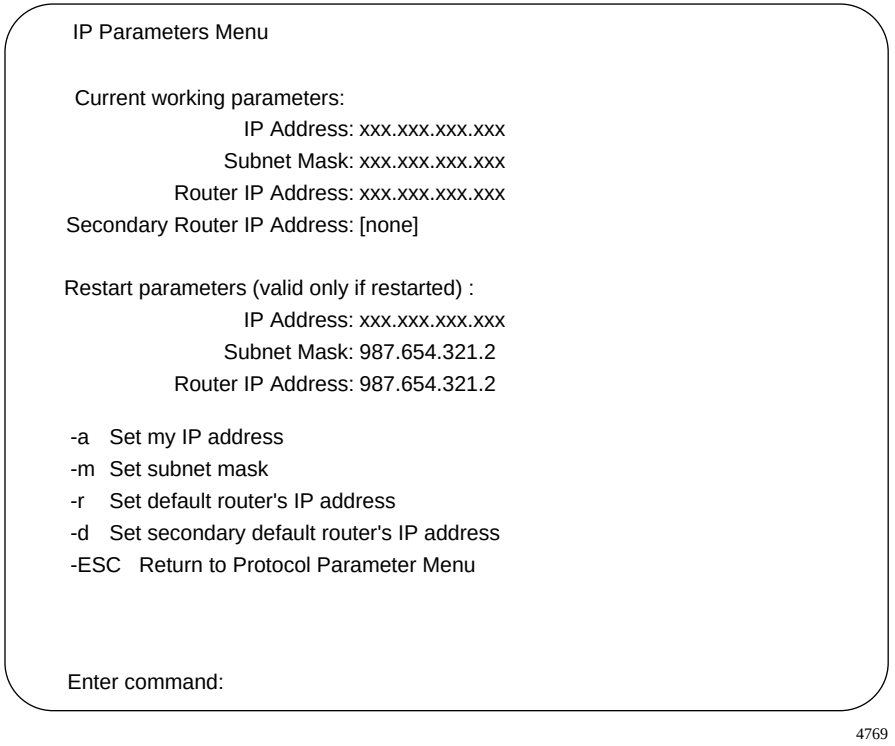


Figure 4-18. Changing the IP parameters

Each time you change one of the run-time parameters on this menu, the screen scrolls to show the new setting on the “Restart parameters” part of the menu. This menu includes the following commands:

a **[Set my IP address]** Up to 12 numeric characters, written in dotted decimal notation (N.N.N.N, with N being a value from 0 to 255, inclusive). These characters identify the network address of the Model 281xSA hub. To set this address to [none], enter 0.0.0.0. If the address is none, that parameter entry remains blank at the top of the menu.

m **[Set subnet mask]** Up to 12 numeric characters, written in dotted decimal notation. To set this address to [none], enter 0.0.0.0. See “Subnetting” in Appendix F, “IP Addressing,” for a description of subnet addresses.

r **[Set router's IP address]** Up to 12 numeric characters, written in dotted-decimal notation. To set this address to [none], enter 0.0.0.0.

d **[Set secondary default router's IP address]** Up to 12 numeric characters, written in dotted-decimal notation. To set this address to [none], enter 0.0.0.0.

ESC **[Return to Protocol Parameters Menu]** Returns the display to the Protocol Parameters menu.

IPX Parameters Menu

When you select the x command [Set IPX parameters] from the Protocol Parameters menu, the menu in Figure 4-19 is displayed.

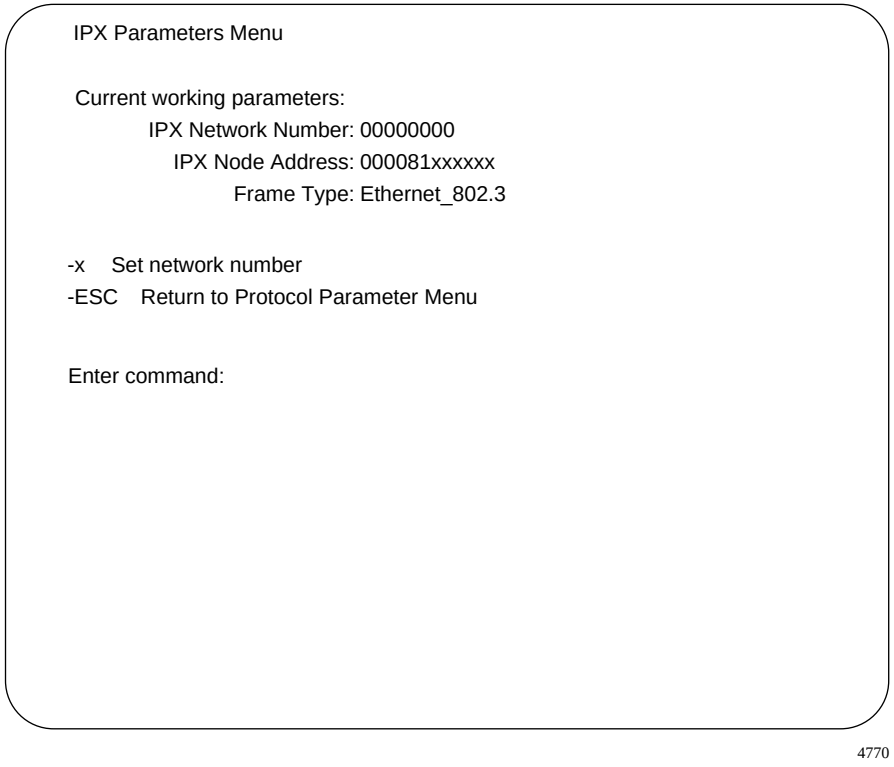


Figure 4-19. IPX Parameters menu

This menu includes the following commands:

x **[Set network number]** Eight numeric characters, identifying the IPX network number the Model 281xSA hub is attached to. This is the network address the Model 281xSA hub uses during operation. To set this address to [none], delete the entry.

ESC **[Return to Protocol Parameters Menu]** Returns the display to the Protocol Parameters menu.

SNMP Parameters Menu

When you select the s command [Set SNMP parameters] from the run-time parameters menu, the menu shown in Figure 4-20 is displayed.

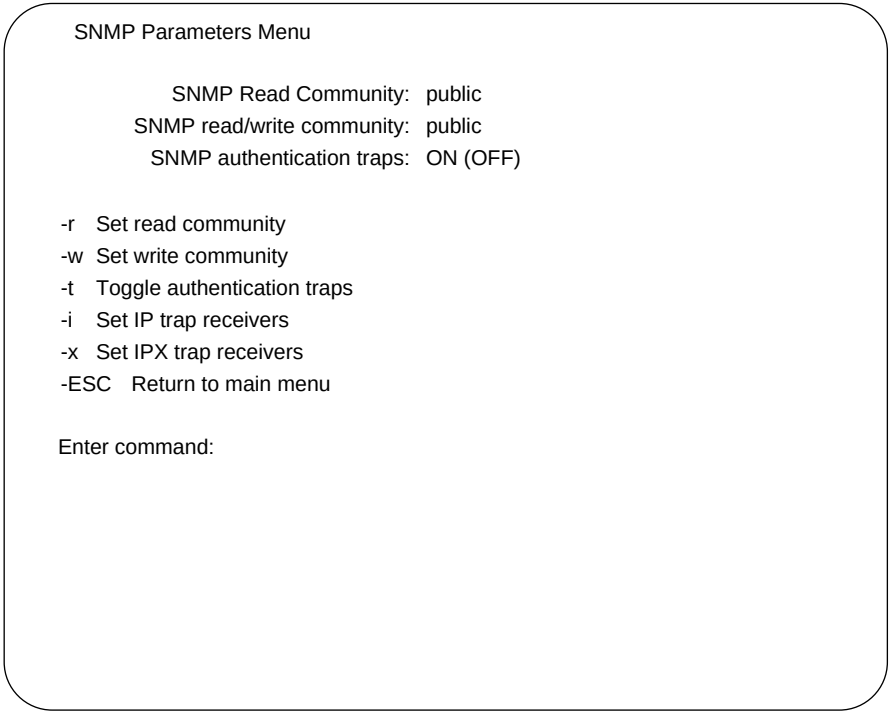


Figure 4-20. SNMP Parameters menu

This menu includes the following commands:

r **[Set read community]** Up to 20 alphanumeric characters that specify the SNMP community string used for read-only SNMP operations. To set this value to [none], press [Enter] without typing any other characters. This disables access to the read-only objects.

w **[Set read/write community]** Up to 20 alphanumeric characters that specify the SNMP community string used for read and write SNMP operations. To set this value to [none], press [Enter] without typing any other characters. This disables access to the read/write SNMP operations.

t **[Toggle authentication traps]** Switches the SNMP authentication traps for IP and IPX between On and Off.

i **[Set IP trap receivers]** Displays a menu (see the next section, "SNMP Trap Receivers for IP") that allows you to list up to 10 IP addresses to send SNMP trap messages.

x **[Set IPX trap receivers]** Displays a submenu (see "SNMP Trap Receivers for IPX," later in this chapter) that allows you to list up to 10 IPX addresses to send SNMP trap messages.

ESC **[Return to main menu]** Returns the display to the main menu.

SNMP Trap Receivers for IP

When you select the i command [Set IP trap receivers] from the SNMP Parameters menu, the menu shown in Figure 4-21 is displayed.

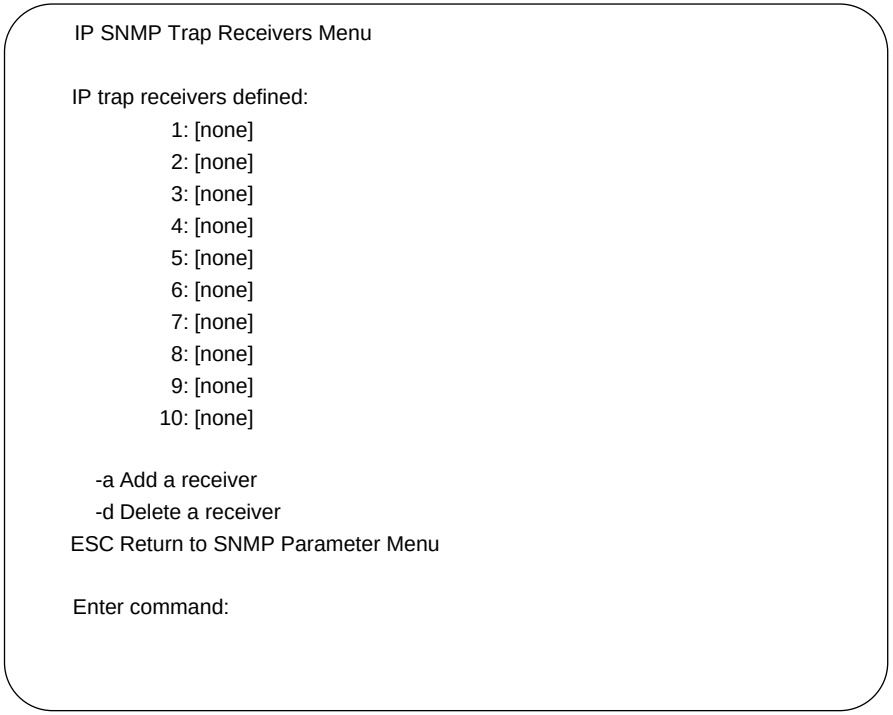


Figure 4-21. SNMP IP Trap Receivers menu

This menu includes the following commands:

a **[Add a receiver]** When you enter this command, the screen displays the message:

```
Enter new trap receiver's IP address:
```

Enter the address of the trap receiver you are adding. It can be up to 12 numeric characters, written in dotted-decimal notation (N.N.N.N, with N being a value from 0 to 255, inclusive). When you press [Enter], the screen displays the message:

```
Enter new trap receiver's community string:
```

Enter the community string of the new trap receiver. When you press [Enter], the screen displays the message:

```
Enter new trap receiver's age-out time
(in unit of 10 msec):
```

Enter the age-out time of the new trap receiver. The screen scrolls and adds a new entry to the displayed list of defined trap receivers.

NOTE: *The age-out time specifies the length of time in milliseconds an entry may stay in the trap receiver's table. Once an entry ages out, it is removed from the table. When a management station learns about a Model 281xSA hub on the network, it automatically registers its IP address in the trap receivers table and sets the age-out timer to 180,000 milliseconds (30 minutes). Every 10 minutes it reregisters. If a management station is removed from the network or does not reregister, the Model 281xSA hub ages out the IP address. When the timer is set to 0 milliseconds, the entry never ages out.*

d **[Delete a receiver]** When you issue this command, the screen displays the message:

```
Enter the number of the entry to delete:
```

Enter the number (1 through 10) of the entry you are deleting. The screen scrolls and changes the deleted entry to read [none] on the displayed list of defined trap receivers.

ESC **[Return to SNMP Parameters Menu]** Returns the display to the SNMP Parameters menu.

SNMP Trap Receivers for IPX

When you select the x command [Set IPX trap receivers] from the SNMP Parameters menu, the menu shown in Figure 4-22 is displayed.

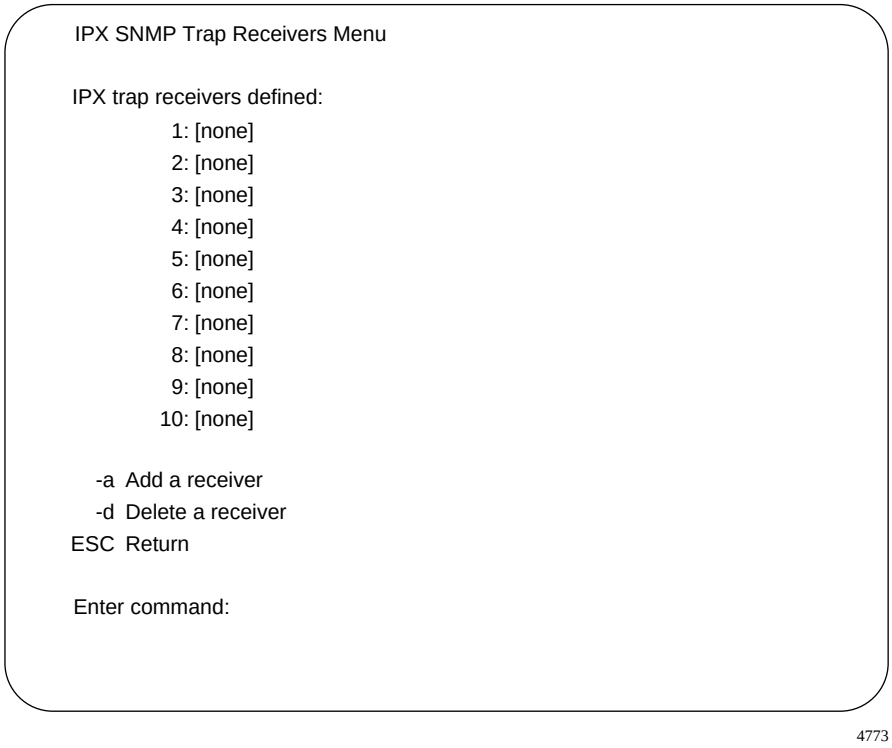


Figure 4-22. SNMP IPX Trap Receivers menu

This menu includes the following commands:

a **[Add a receiver]** When you enter this command, the screen displays the message:

```
Enter new trap receiver's IPX network number
(in hexadecimal):
```

Enter the IPX network number of the trap receiver you are adding. It must be eight hexadecimal characters. To set this address to [none], enter 00000000. When you press [Enter], the screen displays the message:

```
Enter new trap receiver's IPX node address
(in hexadecimal):
```

Enter the IPX node address of the trap receiver you are adding. It must be 12 hexadecimal characters. When you press [Enter], the screen displays the message:

```
Enter new trap receiver's community string:
```

Enter the community string of the new trap receiver. When you press [Enter], the screen displays the message:

```
Enter new trap receiver's age-out time
(in units of 10 msec):
```

Enter the age-out time of the new trap receiver. The screen scrolls and adds a new entry to the displayed list of defined trap receivers.

NOTE: *The age-out time specifies the length of time in milli-seconds an entry may stay in the trap receiver's table. Once an entry ages out, it is removed from the table. When a management station learns about a Model 281xSA hub on the network, it auto-matically registers its IPX address in the trap receivers table and sets the age-out timer to 180,000 milliseconds (30 minutes). Every 10 minutes it reregisters. If a management station is removed from the network or does not reregister, the Model 281xSA hub ages out the IPX address. When the timer is set to 0 milliseconds, the entry never ages out.*

d **[Delete a receiver]** When you issue this command, the screen displays the message:

```
Enter the number of the entry to delete:
```

Enter the number (1 through 10) of the entry you are deleting. The screen scrolls and changes the deleted entry to read [none] on the displayed list of defined trap receivers.

ESC **[Return to SNMP Parameters Menu]** Returns the display to the SNMP Parameters menu.

Out-of-Band Parameters Menu

When you select the o command [Set out-of-band parameters] from the run-time parameters menu, the menu in Figure 4-23 is displayed.

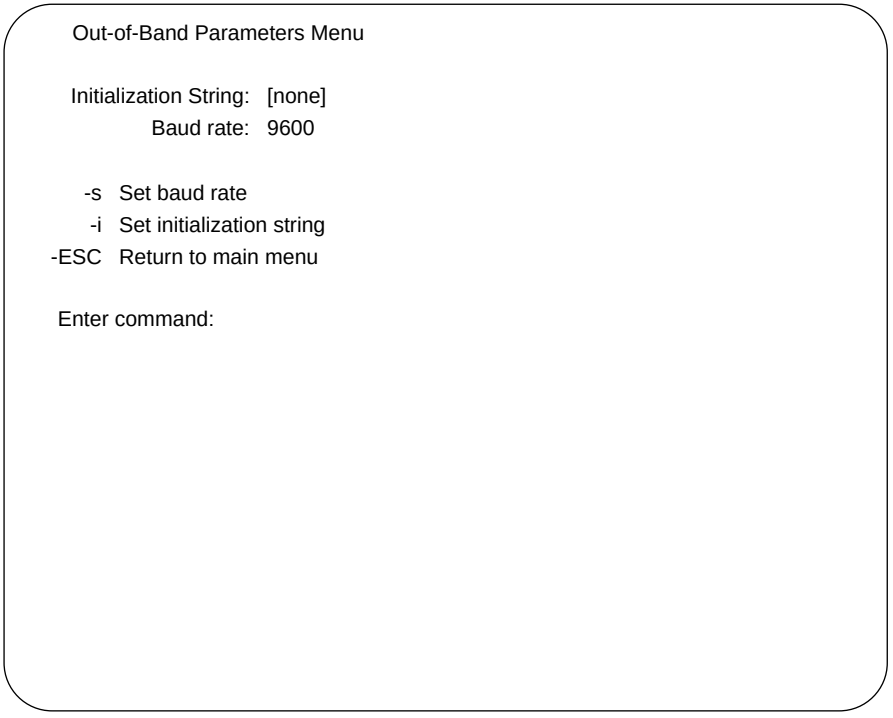


Figure 4-23. Out-of-Band Parameters menu

This menu includes the following commands:

s **[Set baud rate]** Shifts display to another menu with selections for possible baud rate settings for the external modem. Possible choices for the baud rate are:

1 300
2 1200
3 2400
4 4800
5 9600

After selecting one of the baud rate settings, press [ESC] to return to the Out-of-Band Parameters menu.

i **[Set initialization string]** Up to 64 characters for the Model 281xSA hub initialization string. This is the string of characters that a management station dials to establish out-of-band contact with the Model 281xSA hub in case of network problems.

ESC **[Return to main menu]** Returns the display to the main menu.

Setting Security Parameters

When you select the c command [Set security parameters] from the run-time parameters menu, the menu in Figure 4-24 is displayed.

The service port on the Model 281xSA hub features a security lock software switch for protection of the node security configuration. This switch lets you prevent unauthorized changes to the security settings without physical access to the hub. When the security configuration lock is set to ON, Allowed Nodes settings cannot be modified from management stations. Authorized changes to the configuration will require changing the lock setting at the service port.

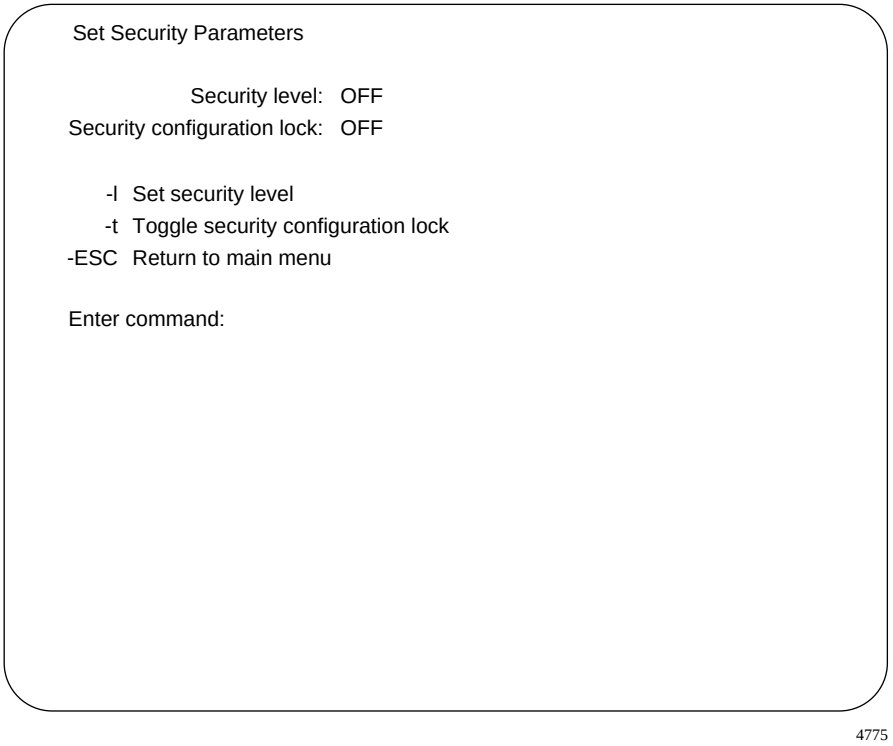


Figure 4-24. Set Security Parameters menu

This menu includes the following commands:

l **[Set security level]** Shifts display to another menu from which you can disable security altogether or enable security at the hub, slot, or port level.

t **[Toggle security configuration lock]** Shifts the security configuration lock between ON and OFF.

ESC **[Return to main menu]** Returns the display to the main menu.

Profile Parameters Menu

When you select the p command [Set profile parameters] from the run-time parameters menu, the menu in Figure 4-25 is displayed.

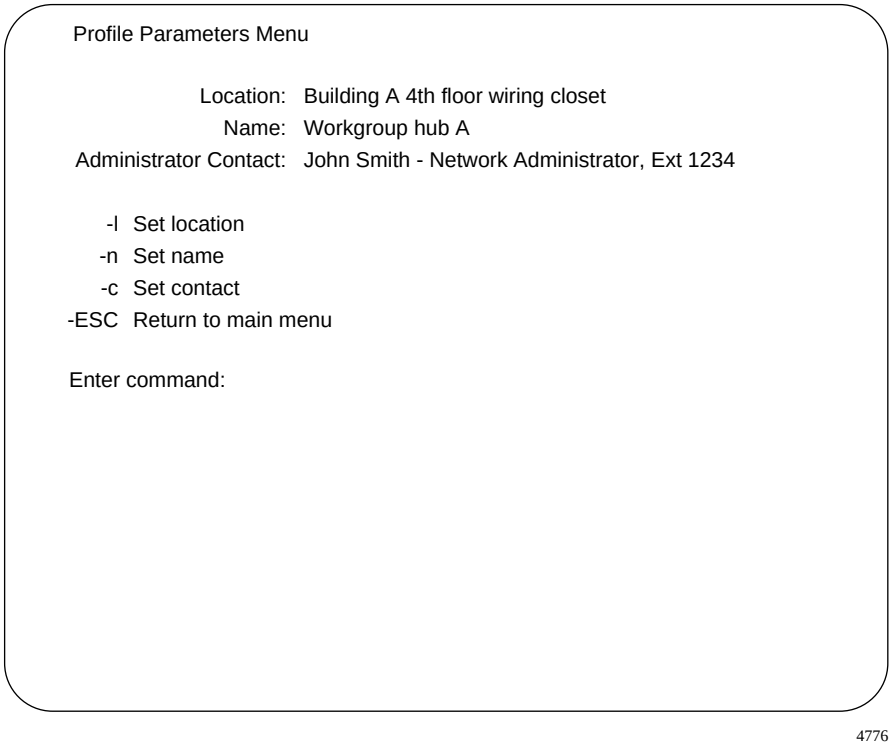


Figure 4-25. Profile Parameters menu

This menu includes the following commands:

l **[Set location]** Up to 64 alphanumeric characters that represent the location of the Model 281xSA hub. This entry is useful for determining the physical location of a hub.

n **[Set name]** Specifies a name for the Model 281xSA hub.

c **[Set contact]** Specifies the person who should be contacted about matters pertaining to the Model 281xSA hub.

ESC **[Return to main menu]** Returns the display to the main menu.

Boot Parameters Menu

When you select the b command [Set boot parameters] from the run-time parameters menu, the menu in Figure 4-26 is displayed.

```
Boot Parameters Menu

                  Local Image Status:  On-Board Version 1.0.0
                         Boot Mode:  Use EEPROM (Use NETWORK)
                       Boot Protocol:  Auto (IP, IPX, IP_IPX)
                    Image Load Mode:  REMOTE (LOCAL)  (REMOTE w/LOCAL)
                    Config Load mode:  REMOTE (LOCAL)  (REMOTE w/LOCAL)
               Boot Router IP Address:  xxx.xxx.xxx.xxx
               Boot Server IP Address:  xxx.xxx.xxx.xxx
                     Image File Name:  c:\comm\281xSA.img
                     Config File Name:  C:\COMM\281XSA.CFG

  -m  Toggle boot mode
  - p  Toggle boot protocol
  - t  Toggle image load mode
  - c  Toggle config load mode
  - b  Set boot router's IP address
  - s  Set boot server's IP address
  - i  Set image file name
  - f  Set config file name
 -ESC  Return to main menu

   Enter command:
```

4777.1

Figure 4-26. Boot Parameters menu

This menu includes the following commands:

m **[Toggle boot mode]** Shifts the boot mode between Network and NVRAM. The factory default setting is Network.

When Network is selected, the Model 281xSA hub tries to acquire its configuration over the network, using the protocol specified by the p command [Toggle boot protocol].

When NVRAM is selected, the Model 281xSA hub configures itself during power-on or reset using the parameter values obtained from the NVRAM (if they exist).

NOTE: *When NVRAM is selected as the boot mode, you must use the menu selections to set or change the required parameters.*

p **[Toggle boot protocol]** Shifts the boot protocol among Auto, IP, IPX, and IP_IPX. The factory default setting is Auto.

NOTE: *If m [Toggle boot mode] is set to NVRAM, this parameter is ignored.*

When Auto is selected, the Model 281xSA hub tries to find its IP or IPX configuration parameters over the network. This process has two stages:

- First the Model 281xSA hub seeks the IP parameters and configuration file from a BootP server, transfers the configuration file, and writes the values (if it finds them) into NVRAM. (Without IP parameters stored in NVRAM, this Model 281xSA hub cannot be managed by IP.)
- Then the Model 281xSA hub seeks the IPX parameters and configuration file from a Novell server and writes the values into NVRAM.

As long as it can find either IP or IPX parameters, the Model 281xSA hub writes the values into NVRAM. If the Model 281xSA hub fails to locate either an IP BootP server or a Novell (IPX) server or router, it resets and starts over.

When IP is selected, the Model 281xSA hub tries to locate a BootP server and load the IP parameter values. It also writes these values into NVRAM. If it cannot find a BootP server or transfer the configuration file, it times out and returns to the Boot main menu without obtaining a network address. If IP is selected, the Model 281xSA hub does not look for IPX parameters.

When IPX is selected, the Model 281xSA hub looks for a Novell server or router from which it can obtain the IPX network number. If no server or router responds, the Model 281xSA hub returns to the Boot main menu. When IPX is selected, the Model 281xSA hub does not look for a BootP server.

When IP_IPX is selected, the Model 281xSA hub looks for *both* a BootP server (to provide the IP parameters) *and* a Novell server or router (to provide the IPX parameters). First the Model 281xSA hub looks for a BootP server. If it finds a BootP server, the hub downloads the configuration file without continuing to seek an IPX address. If the hub cannot find a BootP server, it looks for a Novell server or router. If it finds one, it transfers the configuration file, obtains the IPX network number, and writes the parameter values into NVRAM. If it fails to find IP parameters, the Model 281xSA hub resets itself and starts the booting process over.

t **[Toggle image load mode]** Shifts the image load mode among Remote, Remote w/Local, and Local. The factory default setting is Remote w/Local.

When Remote is selected, the Model 281xSA hub tries to download the image file according to the boot mode specified by the m command [Toggle boot mode]. The image file is never loaded from local flash EPROM, even if downloading fails and the local image file exists.

When Remote w/Local is selected, the Model 281xSA hub tries to download the image file according to the boot mode setting. The local image is used as a backup in case the remote download fails. If the download fails, instead of resetting itself and starting the process over, the Model 281xSA hub loads the image file from local flash EPROM.

When Local is selected, the Model 281xSA hub loads the image file from onboard local flash EPROM. When you set the image load mode to Local, the boot mode setting is no longer important (that is, the Model 281xSA hub performs only a local load of the image file).

NOTE: *If the local image file is corrupted, you are not allowed to set the image load mode to Local.*

c **[Toggle config load mode]** Shifts the configuration file load mode among Remote, Remote w/Local, and Local. The factory default setting is Remote w/Local.

When Remote is selected, the Model 281xSA hub tries to down-load the configuration file according to the boot mode specified by the m command [Toggle boot mode]. The configura-tion file is never loaded from local flash EPROM, even if downloading fails and the local configuration file exists.

When Remote w/Local is selected, the Model 281xSA hub tries to download the configuration file according to the boot mode setting. The local configuration file is used as a backup in case the remote download fails. If the download fails, instead of resetting itself and starting the process over, the Model 281xSA hub loads the configuration file from local flash EPROM.

When Local is selected, the Model 281xSA hub loads the configuration file from onboard local flash EPROM. When you set the configuration load mode to Local, the boot mode setting is no longer important (that is, the Model 281xSA hub performs only a local load of the configuration file).

b **[Set boot router's IP address]** Up to 12 numeric characters, written in dotted-decimal notation. To set this address to [none], enter 0.0.0.0.

s **[Set boot server's IP address]** Up to 12 numeric characters, written in dotted-decimal notation. This is the IP address of the host that provides the files for boot loading the hub. To set this address to [none], enter 0.0.0.0.

i **[Set image file name]** Up to 64 ASCII characters. Identifies the pathname and filename specifying the Model 281xSA hub image file to be loaded. The string format is specific to the operating system used by the TFTP server. For example, if the TFTP server is an MS-DOS-based implementation, a sample string can be:

```
c:\tftpboot\281xSA.img
```

If the TFTP server is UNIX based, a sample string can be:

```
/tftpboot/281xSA.img
```

f **[Set boot file name]** Up to 64 ASCII characters. Identifies the pathname and filename specifying the Model 281xSA hub configuration file to be loaded. The string format is specific to the operating system used by the TFTP server. For example, if the TFTP server is an MS-DOS-based implementation, a sample string can be:

```
c:\tftpboot\281x50.cfg
```

If the TFTP server is UNIX based, a sample string can be:

```
/tftpboot/281x50.cfg
```

ESC **[Return to main menu]** Returns the display to the main menu.

Appendix A Technical Specifications

This appendix provides technical specifications for the Model 281xSA Ethernet Hub.

Network Protocol

10 Mb/s Manchester encoded (IEEE 802.3 CSMA/CD)

Standards Support

IEEE 802.3i Type 10BASE-T
IEEE 802.3 10BASE-FL draft standard

Electrical Specifications

Input power:	40 W
Thermal rating:	136 BTU/hr maximum
AC line frequency:	50–60 Hz
Input voltage:	100–240 VAC
Volt amperes rating:	1.0 A at 100 V AC
	0.5 A at 240 V AC
Fuses:	Internal
Fuse rating:	2 A at 240 V AC

Optical Specifications (Model 2814SA Ethernet Hub)

Optical transmit range:	-12 dBm to -18 dBm
Optical receive average power range:	-12 dBm to -32.3 dBm

Physical Specifications

Weight:	8.2 lb (3.7 kg)
Dimensions:	(W) 17.3 by (D) 7.2 by (H) 2.5 in
	(W) 43.9 by (D) 18.2 by (H) 6.3 cm
Rack space:	1.5 rack-mount spaces

Environmental Specifications

Operating temperature:	5° to 40° C
Storage temperature:	-25° to +70° C
Operating humidity:	85% maximum relative humidity, noncondensing
Storage humidity:	95% maximum relative humidity, noncondensing
Operating altitude:	10,000 ft (3,000 m) maximum

Electromagnetic Emissions

Meets requirements of: FCC Part 15, Subparts A and B, Class A
EN 55 022 (CISPR 22:1985), Class B
General License VDE 0871, Class B
(AmtsblVfg No. 243/1991 and Vfg 46/1992)
VCCI Class 1 ITE

Safety Agency Approvals

UL-listed
CSA-certified
TUV-licensed

Microprocessors

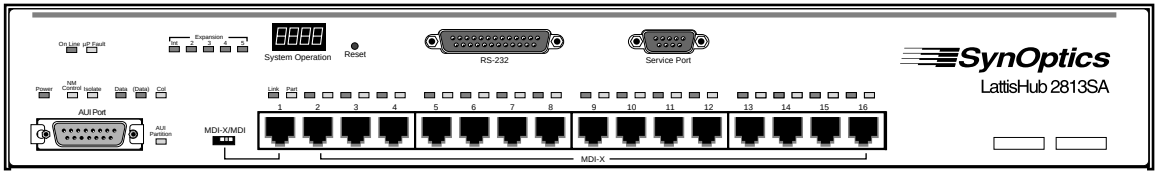
20-MHz Motorola 68EC040 Network Controller
80C52 microcontroller

Memory

2 MB dynamic RAM, upgradable to 8 MB by adding standard RAM SIMMs, plus additional static RAM for specialized functions
512 KB flash EPROM, upgradable to 1 MB
32 KB EEPROM
256 KB boot EPROM

Appendix B LEDs and Switches

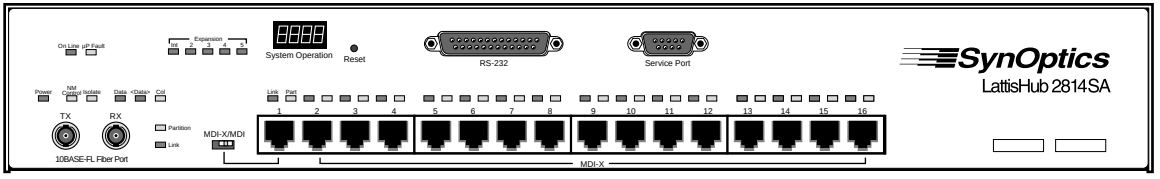
This appendix describes the LEDs and switches on the Model 281xSA Ethernet Hubs. Figure B-1 shows the Model 2813SA Ethernet Hub front panel.



4638

Figure B-1. Model 2813SA Ethernet Hub front panel

Figure B-2 shows the Model 2814SA Ethernet Hub front panel.



4639

Figure B-2. Model 2814SA Ethernet Hub front panel

Table B-1 describes the functions of the LEDs and switches.

Table B-1. Model 281xSA hub LEDs

Type	Label	Color	Meaning
Power LED	Power	Green	DC power is accurately delivered to the internal circuitry of the hub.
Concentrator LEDs	Data	Green	Data is present in the hub.
	<Data>	Green	Stretched LED lights for 34 ms after each data transmission. This allows the eye to perceive very short transmissions.
	Col	Amber	Stretched LED lights for 140 ms indicating a collision in the hub.
	Isolate	Amber	Host portion of the Model 281xSA hub has been partitioned (isolated) by SNMP network management from the extended Model 281xSA "backplane." These 16 ports of the Model 281xSA hub continue to function as their own 16-port Ethernet segment.
AUI Port LED (Model 2813SA hub)	AUI Partition	Amber	AUI port has been autopartitioned because of an excessive number of consecutive collisions, an excessively long single collision signal, or jabber input; or it has been partitioned by SNMP network management.
10BASE-FL Port LEDs (Model 2814SA hub)	Partition	Amber	10BASE-FL port has been autopartitioned because of an excessive number of consecutive collisions, an excessively long single collision signal, or jabber input; or it has been partitioned by SNMP network management.
	Link	Green	Port is connected to another 10BASE-FL or FOIRL port on a powered concentrator or transceiver.
Expansion Port LEDs	Expansion Status Int, 2, 3, 4, 5	Green	Specified expansion port connection to a Model 281xSA hub has been physically completed, and the Model 281xSA hub microcontroller has passed diagnostics. Expansion unit #1 (Int) is the internal host portion of the Model 281xSA hub, and units 2 through 5 are the external Model 280x hub host units.

Table B-1. Model 281xSA hub LEDs (continued)

Type	Label	Color	Meaning
Host Port LEDs (16 pairs)	Part	Amber	Port has been autopartitioned because of an excessive number of consecutive collisions or an excessively long single collision signal; or it has been partitioned by SNMP network management or local hub management.
	Link	Green	Port is connected to another powered 10BASE-T port whose signaling meets the requirements for an IEEE 802.3i 10BASE-T device. This LED turns OFF if a port has been partitioned by network management.
Operation LEDs	On Line	Green	Flashes when the Model 281xSA hub has not yet started to execute the run-time image software code. This LED lights to indicate that the download (or local load) has succeeded and has begun to execute the run-time image. If the µP Fault LED is on, the On Line LED lights to indicate that the concentrator is running its self-test or that the download has failed eight times.
	NM Cntrl	Amber	Lights when the concentrator has been isolated (partitioned) from the cluster "backplane" or when one or more ports have been partitioned by SNMP network management.
	µP Fault	Amber	Lights when a microprocessor fault has occurred in the concentrator. This LED lights during power-on self-test and reset, then turns off if the tests are successful.

Table B-2 describes the meanings of combinations of the µP Fault and On Line LEDs.

Table B-2. Model 281xSA hub µP Fault and On Line LED combinations

µP Fault	On Line	µP Fault
ON	OFF	Running self tests, or download failed after eight attempts.
OFF	Flashing	Waiting for download, or download in progress.
OFF	ON	In operation.

Reset Button

A recessed reset button on the front panel of the Model 281xSA hub is accessible using a jeweler's screwdriver or similar pointed implement (see Figure B-3). Use this button to reset the Model 281xSA hub. Resetting the Model 281xSA hub causes it to go through the complete download/local load process. The reset is similar to turning the Model 281xSA hub power off and then back on, except that data integrity is not interrupted during a reset and is interrupted during a power recycle.

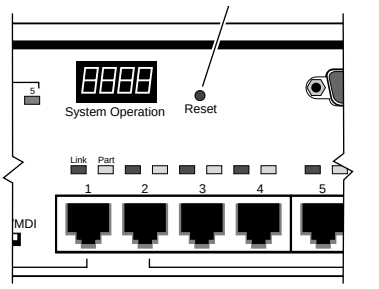


Figure B-3. Reset button

MDI-X/MDI Switch

Model 281xSA hubs allow you to configure port 1 as an MDI or MDI-X port. Media dependent interface (MDI) is specified by the IEEE 802.3i 10BASE-T Standard to be the electrical and mechanical interface to the UTP wire. An MDI port transmits out to the UTP wire on pins 1 and 2 (pair 2 of the 4-pair UTP cable), and receives from the UTP wire on RJ-45 pins 3 and 6 (pair 3 of the 4-pair UTP cable).

For two 10BASE-T devices to communicate, the transmitter of each device must connect to the receiver of the other device. The reversal of the transmit and receive assignments is called a crossover function. Every 10BASE-T link segment requires a crossover function, and it can be implemented in one of two ways:

- Internally, designed as part of the circuitry in the 10BASE-T device (see Figure B-4)

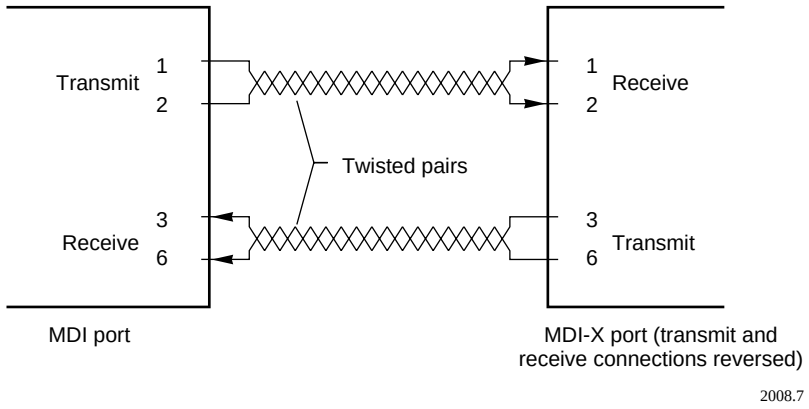


Figure B-4. Internal crossover function

- Externally, with a crossover UTP cable that reverses the transmit and receive wire-pairs at the RJ-45 connector on one end of the UTP cable (see Figure B-5)

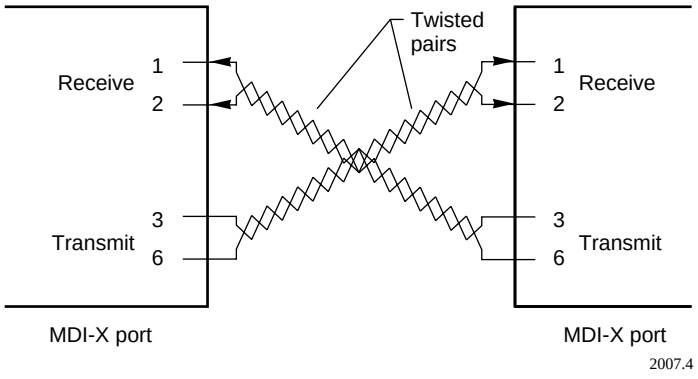


Figure B-5. External crossover function

Implementing the crossover function externally has several disadvantages. You may have to special-order or make your own crossover UTP cable, since this is a nonstandard cable. Having a mixture of straight-through and crossover cables in a network increases the probability of mistaken identification of patch cables. In general, it is more convenient to have the crossover function implemented internally, and this is the recommended way of implementing the crossover.

If the crossover function is implemented internally, that port is designated an MDI-X port (X for crossover function). Internal crossover functions allow the use of standard straight-through UTP cable to connect MDI ports to MDI-X ports. 10BASE-T transceivers are implemented as MDI ports, and 10BASE-T repeaters (for example, ports 2 through 16 of the Model 281xSA hubs) have MDI-X ports.

The Model 281xSA hub configures ports 2 through 16 as MDI-X ports, while port 1 can be configured as either MDI or MDI-X through the MDI-X/MDI switch on the front panel (see Figure B-6).

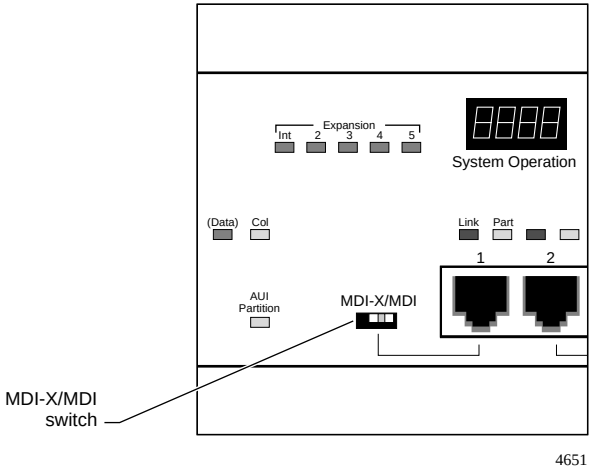


Figure B-6. MDI-X/MDI switch

This feature is very convenient when you interconnect System 2000 hubs through their 10BASE-T ports. It allows you to use a straight-through UTP cable between port 1 (configured as an MDI port) and any of the MDI-X 10BASE-T ports on the interconnected hub. Without the MDI-X/MDI switch, a crossover cable would be required to interconnect the hubs directly through UTP wire.

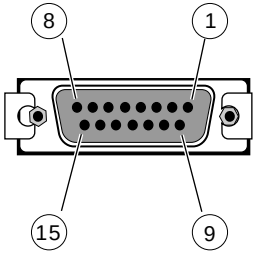
Appendix C Pin Assignments

This appendix lists the pin assignments for the connectors on Model 281xSA Ethernet Hubs and describes how to use the RS-232 port for making out-of-band connections.

AUI Port

Table C-1 shows the pin assignments for the DB-15 connector on the AUI port on the Model 281xSA hub.

Table C-1. AUI port pin assignments (DB-15 socket)

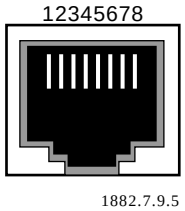
Connector	Pin #	Signal	Pin #	Signal
 2012.4	1	GND	9	CI-B
	2	CI-A	10	DO-B
	3	DO-A	11	GND
	4	GND	12	DI-B
	5	DI-A	13	+12V
	6	GND	14	GND
	7	(NC)	15	GND
	8	GND		

NOTE: *Do not connect the AUI port on a Model 2813SA hub directly to the AUI port on an Ethernet station.*

10BASE-T Ports

Table C-2 shows the RJ-45 pin assignments for the 10BASE-T ports on the Model 281xSA hub.

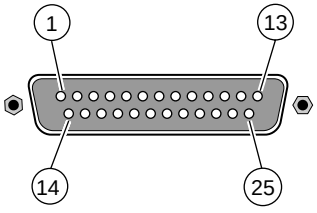
Table C-2. 10BASE-T port pin assignments (RJ-45 jack)

Connector	Pin#	MDI Signal (Function)	MDI-X Signal (Function)
	1	TD + (Transmit to UTP wire)	RD + (Receive from UTP wire)
	2	TD - (Transmit to UTP wire)	RD - (Receive from UTP wire)
	3	RD + (Receive from UTP wire)	TD + (Transmit to UTP wire)
	4	Not used by 10BASE-T	Not used by 10BASE-T
	5	Not used by 10BASE-T	Not used by 10BASE-T
	6	RD - (Receive from UTP wire)	TD - (Transmit to UTP wire)
	7	Not used by 10BASE-T	Not used by 10BASE-T
	8	Not used by 10BASE-T	Not used by 10BASE-T

RS-232 Port

Table C-3 shows the pin assignments for the RS-232 port on the Model 281xSA hub.

Table C-3. RS-232 interface port pin assignments (DB-25 plug)

Connector	Pin #	Function	Direction
	2	Transmit data	from Model 281xSA hub
	3	Receive data	to Model 281xSA hub
	4	Request to send	from Model 281xSA hub
	5	Clear to send	to Model 281xSA hub
	6	Data set ready	to Model 281xSA hub
	7	Signal ground	
	8	Carrier detect	to Model 281xSA hub
	20	Data terminal ready	from Model 281xSA hub
	22	Ring indicator	to Model 281xSA hub

Using the RS-232 Serial Port for an Out-of-band Connection

The RS-232 serial communications port on the Model 281xSA hub can be used for an out-of-band connection to the telephone voice network through an external modem. You must provide the cable between the Model 281xSA hub and the modem.

To connect a Model 281xSA hub to an out-of-band voice network, follow these steps:

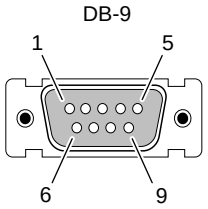
1. **Set up the modem, following instructions in the user's guide for the modem.**
   a. Power up the modem.
   b. Configure the modem. Be sure to set auto-answering ON.
   c. Connect the modem to telephone line through an RJ-11 jack.
2. **Connect the modem to the Model 281xSA hub.**
   a. Connect the plug on the RS-232 serial communications cable to the socket on the modem.
   b. Connect the socket on the RS-232 serial communications cable to the DB-25 plug on the Model 281xSA hub.
3. **Power up the Model 281x or push the reset switch.**

NOTE: *Be sure the modem is powered up before you power up or reset the Model 281xSA hub.*

Service Port

Table C-4 shows the pin assignments for the service port on the Model 281xSA hub.

Table C-4. Service port pin assignments (DB-9 plug)

Connector	Pin #	Function	Direction
	2	Transmit data	from Model 281xSA hub
	3	Receive data	to Model 281xSA hub
	5	Signal ground	–

Appendix D Link Integrity Test Function

Model 281xSA Ethernet Hubs support the IEEE 802.3i 10BASE-T Link Integrity Test function on all their 10BASE-T ports. This function monitors the UTP receive data wire-pair and determines the integrity of the UTP link segment. The 10BASE-T transceiver located at the other end of the link segment also monitors its UTP receive data wire-pair for link integrity. Thus both data wire-pairs of the UTP link segment are tested for link integrity.

At all times, the Model 281xSA hub transmits either data or an idle signal, which is called TP_IDL (twisted-pair idle signal). TP_IDL is transmitted in the absence of data and consists of a repetitive sequence of 100-nanosecond (ns) pulses occurring every 16 milliseconds (ms). The 100-ns pulses are called Link Test Pulses (LTPs).

All Model 281xSA hub ports monitor their receive wire-pair for data and LTP activity. If neither data nor LTPs are detected within 100 ms, the port Link LED goes out to indicate no link status. While there is no link integrity, the Model 281xSA hub port does not send data to the UTP wire, and the port receiver does not forward data from the UTP wire to the concentrator until link integrity is restored.

Appendix E Autopolarity Detection and Correction

All Model 281xSA hub 10BASE-T ports support the automatic polarity detection and correction function, which detects and automatically corrects for UTP receive data wire-pair signal inversions. If any receive data wire-pair is mistakenly reversed in the punchdown block during cable installation, the Model 281xSA hub port internally corrects for the miswiring and the data path operates correctly.

The Model 281xSA hub ports monitor the polarity of the receive data wire-pair only during the power-up sequence or while the Model 281xSA hub port has no link status (Link LED OFF). While a port is being monitored, two conditions may occur:

- If the port receives one normal data packet (no inversion), wire polarity is considered good and the monitoring for that port stops until either the power-up sequence or no link status occurs.
- If the port receives either two consecutive inverted data packets or six consecutive inverted link test pulses, the automatic polarity correction function is enabled to internally correct for the receive data wire-pair inversion. Monitoring stops until either the power-up sequence or no link status occurs.

Because the algorithm monitors both data packets and link test pulses, the automatic polarity correction is enabled even if no data is present on the link segment. There is no indication on the Model 281xSA hub that the wires are reversed, because no user intervention is required to correct this wiring error.

Appendix F IP Addressing

The official description of Internet addresses is RFC 1166, *Internet Numbers*. The DDN Network Information Center (NIC) at SRI International in Menlo Park, California, maintains and distributes the RFC documents. The NIC also assigns Internet addresses and network numbers. When an organization applies to the NIC, the NIC assigns a network number or range of addresses that is appropriate to the number of host devices on the network.

Classes of Internet Addresses

As described in RFC 1166, Internet addresses are 32-bit quantities, divided into five classes. Classes differ in the number of bits allocated to the network and host portions of the address. For this discussion, consider a network to be a collection of computers (hosts) that have the same network field value in their Internet addresses.

The Class A Internet address format (see Figure F-1) uses the highest eight bits as the network field and sets the highest priority bit to 0 (zero). The remaining 24 bits form the host field. Only 128 Class A networks can exist, but each Class A network can have almost 17 million hosts.

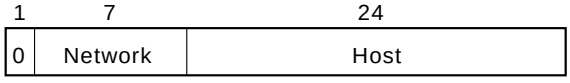


Figure F-1. Class A Internet Address

The Class B Internet address format (see Figure F-2) uses the highest 16 bits as the network field and sets the two highest-order bits to 1,0. The remaining 16 bits form the host field. More than 16,000 Class B networks can exist, and each Class B network can have up to 65,000 hosts.

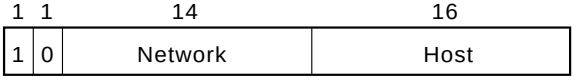


Figure F-2. Class B Internet Address

The Class C Internet address format (see Figure F-3) uses the highest 24 bits as the network field and sets the three highest-order bits to 1,1,0. The remaining eight bits form the host field. More than two million Class C networks can exist, and each Class C network can have up to 255 hosts.

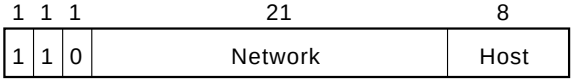


Figure F-3. Class C Internet address

The Class D Internet address format is reserved for multicast groups, as discussed in RFC 1112. In Class D addresses, the four highest-order bits are set to 1,1,1,0.

The Class E Internet address is reserved for future use. In Class E addresses, the four highest-order bits are set to 1,1,1,1. The router currently ignores the Class D and Class E Internet addresses, except for the global broadcast address 255.255.255.255.

Internet Address Notation

Internet addresses are written as four decimal numbers (for example, 255.255.255.255). Each decimal number represents an 8-bit octet. When strung together, the four octets form the 32-bit Internet address. This notation is called dotted-decimal notation.

These examples show 32-bit values expressed as Internet addresses:

192.31.7.19
10.7.0.11
255.255.255.255
0.0.0.0

The largest possible value of a field in a dotted-decimal number is 255, which represents an octet of all ones.

Allowable Internet Addresses

Some Internet addresses are reserved for special uses and cannot be used for host, subnet, or network addresses. Table F-1 lists ranges of Internet addresses and shows which addresses are reserved and which are currently available.

Table F-1. Reserved and available Internet addresses

Class	Address or Range	Status
A	0.0.0.0	Reserved
	1.0.0.0 through 126.0.0.0	Available
	127.0.0.0	Reserved
B	128.0.0.0	Reserved
	128.1.0.0 through 191.254.0.0	Available
	191.255.0.0	Reserved
C	192.0.0.0	Reserved
	192.0.1.0 through 223.255.254	Available
	223.255.255.0	Reserved
D, E	224.0.0.0 through 255.255.255.254	Reserved
	255.255.255.255	Broadcast

Internet Address Conventions

If the bits in the host portion of an address are all 0, that address refers to the network specified in the network portion of the address. For example, the Class C address 192.31.7.0 refers to a particular network.

Conversely, if the bits in the network portion of an address are all 0, that address refers to the host specified in the host portion of the address. For example, the Class C address 0.0.0.234 refers to a particular host.

If the bits in the host portion of an address are all 1, that address refers to all hosts on the network specified in the network portion of the address. For example, the Class B address 128.1.255.255 refers to all hosts on the 128.1.0.0 network. (Remember that an octet of ones becomes the decimal number 255.)

Because of these conventions, do not use an Internet address with all zeros or all ones in the host portion for your router address.

Addresses and Routing

Addresses make it possible to route and deliver data packets. For example, when a host sends an Internet data packet to a destination host on the same network, the packet goes directly to the destination host. If the destination host and sending host are on different networks, the packet goes to a router.

To determine whether the destination host is on the same network, the sending host compares the network portions of the destination address and its own address. If these network numbers are the same, the destination host is on the same network. If the network numbers are different, the destination host is on another network, and the data packet must go to a router.

A router has two or more network interfaces onto different networks. The router's primary function is to direct packets between these networks, delivering them to their final destination or to another router. (A router-to-router transmission is called a hop.)

To begin the routing process, the router examines the network number of the destination address. Using this number as a key, the router locates applicable routing information in its routing table. The router uses this routing information to send the packet to its final destination or to an intermediate destination.

Subnetting

Subnetting is a scheme for imposing a simple hierarchy on hosts on a single physical network. The usual practice is to use the first few bits in the host portion of the network addresses for a subnet field. For example, Figure F-4 shows a Class B address with five bits of the host portion used as the subnet field. The official description of subnetting is RFC 950, *Internet Standard Subnetting Procedure*.

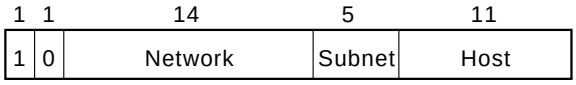


Figure F-4. Subnet field in a Class B address

As with the host portion of an address, do not use all zeros or all ones in the subnet field.

Subnetting and Routing

Routers and hosts can use the subnet field for routing. The rules for routing on subnets are the same as those for routing on networks. However, correct routing requires all subnets of a network to be physically contiguous. In other words, the network must be set up so that it does not require traffic between any two subnets to cross another network. Also, RFC 950 implicitly requires that all subnets of a network have the same number of bits in the subnet field.

Subnet Masks

A subnet mask identifies the subnet field of a network address. This mask is a 32-bit Internet address written in dotted-decimal notation with all ones in the network and subnet portions of the address. For the example in Figure F-4, the subnet mask is 255.255.248.0.

Table F-2 shows the subnet masks you can use to divide an octet into subnet and host fields. The subnet field can consist of any number of the host field bits; you do not need to use multiples of eight. However, you should use three or more bits for the subnet field—a subnet field of two bits yields only four subnets, two of which are reserved (the 1,1 and 0,0 values).

Table F-2. Subnet masks

Subnet Bits	Host Bits	Hex Mask	Decimal Mask
0	8	0	0
1	7	0x80	128
2	6	0xC0	192
3	5	0xE0	224
4	4	0xF0	240
5	3	0xF8	248
6	2	0xFC	252
7	1	0xFE	254
8	0	0xFF	255

Appendix G Setting Up the Model 281xSA Hub Configuration File

The Setup program with your SynOptics network management software installs a sample Model 281xSA hub configuration file, called *281sa100.cfg*. In order to use a BootP server, you must modify this sample configuration file or create one of your own.

NOTE: *Each managed hub on your network requires a unique configuration file.*

You can edit the configuration file with any ASCII text editor, such as the Windows Notepad. Lines beginning with the # character are considered comments. You can modify the sample file for your own use by uncommenting the appropriate keyword lines and specifying the parameter values.

CAUTION: *Before you edit a Model 281xSA hub configuration file, make a backup copy of the file for reference.*

Sample Configuration File

This section provides an example of a complete Model 281xSA hub configuration file. The meanings of the data fields are described in the next section, “Configuration Parameters.”

The IP addresses for default router and trap receivers have been left as dummies (xxx.xxx.xxx.xxx) in the sample files, so as not to accidentally use a real IP address. You must replace the dummy sequences with real addresses appropriate to your network.

You must specify a pathname and a filename for the network management image file; there is no default for this parameter.

NOTE: *The network management image file Parameter must begin in the first column; otherwise, that line is ignored by the Model 281xSA hub.*

The sample configuration file *281sa100.cfg* looks like this:

```
# Specify file name for the NMM image file.  NOTE this has to be the
# first un-commented line in this file for the NMM to load properly.
# For example:
#ensa100.img
#
# Assign local subnet mask for this NMM.
# Default for Class A NMM IP Address is 255.0.0.0.
# Default for Class B NMM IP Address is 255.255.0.0.
# Default for Class C NMM IP Address is 255.255.255.0.
# For example:
#netmask 255.255.255.0
#
# Specify the primary default router for this NMM.
#default-router xxx.xxx.xxx.xxx
# For example:
#default-router 0.0.0.0
#
# Specify the secondary default router for this NMM.
#secondary-default-router xxx.xxx.xxx.xxx
#
# Specify the router address for this NMM's TFTP request.
#boot-router xxx.xxx.xxx.xxx
#
# Enable or disable the automatic discovery of available default
# router(s).  Valid entries are on and off.  Default is on.
# For example:
#ping-router on
#
# Specify the time interval of pinging router(s) in seconds.
# Maximum number is 42,949,672 seconds. (approximate 497 days)
# Default / minimum time is:
#ping-time 60
#
# Specify the Novell network number for this NMM. Must be exactly
# eight hexadecimal digits.
#network-number 00000000
#
# Indicate baud rate used for the RS-232 out-of-band port. Valid
# entries are
# 300, 1200, 2400, 4800 and 9600 baud.
# Default is:
#baud-rate 9600
#
```

```
# Enter the NMM initialization string used for out-of-band
# communication.
# For example:
#initialization-string ATDT,9,1,415-555-1212
#
# Specify the concentrator's location (64 characters max.).
# For example:
#location Building A
#
# Specify the concentrator's name (64 characters max.).
# For example:
#sysname concA.abcCompany.com
#
# Specify the name & phone number  of the concentrator's administrator
# or contact person (64 characters max.).
# For example:
#syscontact John Smith - Network Administrator - ext 5555
#
# Specify the community string used for read only operations.
# Specifying no community string will default to public for read only
# objects.
# For example:
#read-community public
#
# Specify the community string used for read and write operations.
# Specifying no community string will default to private for read and
# writable objects.
# For example:
#write-community private
#
# Enter the list of IP trap receivers along with their community
# strings and ageout times, in seconds. The maximum number is
# 42,949,672 seconds (approx 497 days). Specifying no ageout time
# defaults to indefinite time. Specify only one entry pair per line,
# up to a maximum of 10 entries.
# For example:
#ip-trap-receiver xxx.xxx.xxx.xxx trap-community public 9000
#
# Enter the list of IPX trap receivers along with their community
# strings and ageout times, in seconds. The maximum number is
# 42,949,672 seconds (approx 497 days). Specifying no ageout time
# defaults to indefinite time. Specify only one entry pair per line,
# up to a maximum of 10 entries.
# Entry format is:
# <Novell network #>:<Novell Host #> trap-community <community string>
# <ageout time>
# For example:
#ipx-trap-receiver 00000000:000000000000 trap-community public 9000
```

```
#
# Enable or disable the use of authentication traps. Valid entries are
# on and off.  Default is on.
# For example:
#authentication-traps on
#
# Specify the image load mode for this NMM.  Valid choices are
# remote-only, local-only or remote-with-local-backup.
# For example:
#image-load-mode remote-only
#
# Specify the config load mode for this NMM.  Valid choices are
# remote-only, local-only or remote-with-local-backup.
# For example:
#config-load-mode remote-only
#
# Specify the boot mode for this NMM.  network configures the
# NMM to use the network for remote loading of the NMM's
# configuration information.  eeprom configures the NMM to use
# data stored in NVRAM for local loading.  Default is eeprom.
# For example:
#boot-mode eeprom
#
# Specify the management protocol for this NMM.  Valid choices are
# IP_IPX, IP, and IPX. Default is IP_IPX.
# For example:
#management-protocol IP_IPX
#
# Specify the boot protocol for this NMM.  Valid choices are
# AUTO, IP, IPX, and IP_IPX.  Default is AUTO.
# For example:
#boot-protocol AUTO
#
# Save configuration data to EEPROM.
#save-to-eeprom
#
# Specify time interval of traps sent out for existing predefined
# conditions. The valid range is 10 to 3600 seconds, in 10 second
# increments. Default is 10 seconds.
# For example:
#trap-interval 10
#
# Specify the lifetime of a node list entry in seconds.
# Maximum number is 42,949,672 seconds (approximate 497 days).
# Default is 900 seconds.
# For example:
#portlife 900
#
```

```
# Specify the lifetime of a traffic matrix entry in seconds.
# Maximum number is 42,949,672 seconds (approximate 497 days).
# Default is 1200 seconds.
# For example:
#trflife 1200
#
# Specify how many nodes are allowed to associate with a particular
# port. Default is 800.
# For example:
#max-nodes-per-port 800
#
# Specify allowed nodes for this NMM.  Specify only one entry per
# line. The format is:
#       node AABBCCDDEEFF slot# port#
# Where AABBCCDDEEFF is the hexidecimal MAC address with 12 hex
# digits. slot# and port# are decimal numbers.
# For example:
#node 013489ABCDEF 1 6
#node abcdef987654 2 5
#node 000081111111 2 6
#node 000082222222 2 7
#node 000083333333 2 8
#
# "Wild card" notation:
# If slot# or port# is either 0 or blank, that entry will be treated
# as a wild card.
# For example, this wild card entry specifies all ports associated
# with the concentrator:
#node 1234567890ab
# This wild card entry also specifies all ports associated
# with the concentrator:
#node 1234567890ab 0 0
# This wild card entry specifies all ports associated with slot 5
# in this concentrator:
#node 234567890abc 5 0
#
# Enable allowed nodes and set the security level to be used
# when the system is up.  Security can be set at either concentrator,
# slot, or port level.  System default is OFF for allowed nodes
# features; to enable allowed nodes, uncomment the appropriate line.
# For example:
#allow-on conc
#allow-on slot
#allow-on port
#
```

```
# Specify the action to be taken when a node security violation
# occurs. Actions can be specified for violations at the port, slot,
# or concentrator level.  Formats are
#         port slot# port# action#
#         slot slot# action#
#         conc action#
# Where slot#, port#, action# are all decimal numbers.
# For action#, valid choices are 2, 3, 4, or 5.
# 2 = no_action;
# 3 = send_trap_only;
# 4 = partition_port_only;
# 5 = send_trap_and_partition_port;
#
# This port-level example is used to check slot 5, port 11.
# If address violation occurs, send trap only.
#port 5 11 3
# This port-level example is used to check slot 4, port 12.
# If address violation occurs, do nothing.
#port 4 12 2
# This port-level example is used to check slot 2, port 3.
# If address violation occurs, send trap and partition port.
#port 2 3 5
#
# This slot-level example is used to check slot 5 and
# partition that port if address violation occurs.
#slot 5 4
# This slot-level example is used to check slot 3 and
# send trap and partition that port if address violation occurs.
#slot 3 5
#
# This concentrator-level example is used to check
# entire concentrator.  If address violation occurs,
# send a trap and partition the port to which the concentrator
# is connected.
#conc 5
#
# Lock/Unlock security configuration. Valid entries are on and off.
# Default is off.
# For example:
#security-config-lock off
#
# Add an entry to the threshold table.
# Format of the command:
# threshold IN OB SL PO TY CN SV AC DU
# IN = index, for 281xSA from 1 to 160, inclusive
```

```
# OB = object, which is one of the following:
#    conc     Threshold is set for a concentrator
#    slot     Threshold is set for a slot
#    port     Threshold is set for a port
# SL = slot number, for 281xSA concentrator from 1 to 5, inclusive
# PO = port number, from 1 to 17, inclusive
# TY = type, which is one of the following:
#    good-bytes
#    good-packets
#    bad-packets
#    crc-error-packets
#    misaligned-packets
#    runt-packets
#    fragments
#    too-long-packets
#    collisions
#    late-collisions
#    link-status
#    multicast-packets
#    broadcast-packets
#    short-events
#    source-address-changes
#    data-rate-mismatches
#    network-errors
#    backoff-errors
#    bad-to-good-packets-ratio
#    network-errors-to-good-packets-ratio
#    collisions-to-good-packets-ratio
# CN = condition, which is one of the following, depending on TY:
#    cross       Trigger alarm when actual-value crosses set-value
#    over        Trigger alarm when actual-value is greater than set
#                value
#    over-rate   Trigger alarm when actual-value/second is greater
#                than set-value/second
#    link-on     Trigger alarm when port link status is on
#    link-off    Trigger alarm when port link status is off
#    over-rate   Actual-value/second is greater than set-value/second
#    over-ratio  Actual-value (ratio type only) is greater than set
#                value
# SV = set value, which can be an absolute number or a rate per second
# AC = action, which is one of the following:
#    trap-only            Send trap only
#    partition-slot       Partition a slot, specified by SL
#    partition-port       Partition a port, specified by SL and PO
#    trap-partition-slot  Send trap and partition a slot, specified by
#                         SL
#    trap-partition-port  Send trap and partition a port, specified by
#                         SL and PO
```

```
# DU = Duration in seconds of period during which threshold is
#      monitored. The duration is in multiples of 10 seconds.
#
# Sample threshold table entries:
# This sample threshold table entry is number 6 in the table.
# It counts CRC error packets for a concentrator.  When the number
# of CRC errors in 10 second goes over 1000, it sends a trap.
#threshold 6 conc 0 0 crc-error-packets over 1000 trap-only 10
#
# This sample threshold entry is number 2 in the table.
# It checks slot 3 for 200 good bytes in 10 seconds.  When the counter
# crosses 200, it sends a trap and partitions the slot.
#threshold 2 slot 3 0 good-bytes cross 200 trap-partition-slot 10
#
# Enable or disable automatic network topology build-up.
# Valid entries are on and off.  Default is on.
# For example:
#hello-message on
#
# Specify the maximum number of hosts to be collected on an interface
# on behalf of each for each RMON hostControlEntry.
# The valid range is [100, 2048]. Default is 100.
# For example:
# rmon-max-host 100
```

Configuration Parameters

This section describes each parameter in the Model 281xSA hub configuration file *281sa100.cfg*. To modify the file, use an ASCII text editor, such as the Windows Notepad, to change parameter values or to add or delete parameters.

Parameter names are shown here in **boldface**. You must replace the *parameter arguments* shown in *italics* with specific values. If multiple arguments are shown separated by a vertical bar (|), you may enter any one of the displayed values. (Note that this use of the vertical bar is different from its use in BOOTPTAB.TXT to separate records.)

NOTE: *The **parameter** must begin in the first column; otherwise, the line is ignored by the Model 281xSA hub.*

Dotted-decimal notation, used with the IP address values, takes the form N.N.N.N, where N is a numeric value from 0 to 255 inclusive. Unlike IP addresses in BOOTPTAB.TXT, N is always interpreted as a decimal number.

These are the configuration file parameters:

filename or *drive:\directory\filename*

The pathname and filename for the Model 281xSA hub image file. This parameter must be the first uncommented line in the configuration file. You may include the drive as part of the path.

CAUTION: *This parameter is mandatory. If you do not enter a valid filename or c:\directory\filename, the Model 281xSA cannot boot and fails to operate.*

netmask *ip_address*

The local subnet mask for this Model 281xSA hub—up to 12 numeric characters in typical IP dotted-decimal notation. If no entry exists in the configuration file, one of the following default addresses will be used (depending on what class of IP address is defined for your network):

Default for class A IP address is 255.0.0.0

Default for class B IP address is 255.255.0.0

Default for class C IP address is 255.255.255.0

default-router *ip_address*

The address of the primary default router for this Model 281xSA hub—up to 12 numeric characters in typical IP dotted-decimal notation. To cancel this address, use 0.0.0.0. If no entry exists in the configuration file, the default is none.

secondary-default-router *ip_address*

The address of the secondary default router for this Model 281xSA hub—up to 12 numeric characters in typical IP dotted-decimal notation. To cancel this address, use 0.0.0.0. If no entry exists in the configuration file, the default is none.

boot router *ip_address*

The address of the router for this hub's TFTP request.

ping router *on|off*

Enables or disables the ability of the Model 281xSA hub to issue an Internet Control Message Protocol (ICMP) echo, (ping) to the available default routers. Valid entries are off and on. Default setting is on.

ping-time *nn*

Specifies the time interval of pinging router(s) in seconds. Maximum number is 42,949,672 (approximately 497 days). Default (minimum) time is 60 seconds.

network-number *XXXXXXXX*

The Novell network number for this Model 281xSA hub. The number must be an eight-digit hexadecimal number.

baud rate *300|1200|2400|9600*

The data rate used by the RS-232 out-of-band port. The five values shown are the only valid entries. If no entry exists in the configuration file, the default is 9600.

initialization-string *string*

The initialization string the Model 281xSA hub uses for out-of-band communication (64 alphanumeric characters maximum). This is the string of characters that a management station dials to establish an out-of-band connection if there is an interruption in normal network communication. If the configuration file contains no entry for this parameter, the default is none.

location *string*

The Model 281xSA hub location (64 alphanumeric characters maximum). This parameter can be any convenient identifier that describes where the hub is physically situated. If the configuration file contains no entry for this parameter, the default is none.

sysname *string*

The hub name (64 alphanumeric characters maximum). This parameter can be any convenient identifier that gives the unique hub identification. If the configuration file contains no entry for this parameter, the default is the string “SYNOPT” followed by the last six digits of the hub MAC address.

syscontact *string*

The name and phone number of the administrator or contact person for the hub (64 alphanumeric characters maximum). If the configuration file contains no entry for this parameter, the default is the string “syscontact is not set.”

read-community *public*

The community string used for read-only SNMP operations (20 alphanumeric characters maximum). If you do not specify a community string, access to the read-only objects is disabled. If the configuration file contains no entry for this parameter, the default is public.

write-community *private*

The community string used for read and write SNMP operations (20 alphanumeric characters maximum). If you do not specify a community string, access to the read/write objects is disabled. If the configuration file contains no entry for this parameter, the default is private.

IP-trap-receiver <*ipaddress*> <*trap-community string*> <*age-out*>

A list of IP trap receivers along with their community strings. Each entry must occupy a separate line, up to a maximum of 10 entries. The *ipaddress* can be up to 12 numeric characters, written in dotted-decimal notation. The *trap-community string* parameter is similar to the read-community keyword; it can be any ASCII string, up to a maximum of 20 alphanumeric characters. If you enter an *ipaddress* with no *trap-community string*, the default string is *public*. The *age-out* timer specifies the length of time in seconds that an entry remains in the IP-trap-receiver table.

IPX-trap-receiver <*ipxaddress*> <*trap-community string*> <*age-out*>

A list of IPX trap receivers along with their community strings. Each entry must occupy a separate line, up to a maximum of 10 entries. The *ipxaddress* consists of the 8-digit network number, followed by a colon and the 12 hexadecimal characters of the node address. The *trap-community string* parameter is similar to the read-community keyword; it can be any ASCII string, up to a maximum of 20 alphanumeric characters. If you enter an *ipxaddress* with no trap-community, the default string is *public*. The *age-out* timer specifies the length of time in seconds that an entry remains in the IPX-trap-receiver table.

authentication-traps *on*|*off*

Enables or disables the use of IP and IPX authentication traps. If no entry exists in the configuration file, the default is on (enabled).

image-load-mode *remote-only*|*local-only*|*remote-with-local-backup*

Specifies the image load mode for this hub. For a detailed description, see Chapter 4, “Configuring the Model 281xSA Hub for IP/IPX Networks.”

config-load-mode *remote-only*|*local-only*|*remote-with-local-backup*

Specifies the configuration load mode for this hub. For a detailed description, see “Boot Configuration Commands” in Chapter 4, “Configuring the Model 281xSA Hub for IP/IPX Networks.”

boot-mode *network*|*eeprom*

Specifies the boot mode for this hub. For a detailed description, see Chapter 4, “Configuring the Model 281xSA Hub for IP/IPX Networks.”

management-protocol *IP_IPX|IP|IPX*

Specifies the network management station protocol for this hub. For a detailed description, see Chapter 4, “Configuring the Model 281xSA Hub for IP/IPX Networks.”

boot-protocol *Auto|IP|IPX|IPX_IP*

Specifies the boot protocol for this hub. For a detailed description, see Chapter 4, “Configuring the Model 281xSA Hub for IP/IPX Networks.”

save-to-eeprom

Instructs the Model 281xSA hub to save the current configuration data to EEPROM during the boot time. If the configuration file contains no entry for this parameter, the default is no save.

trap-interval *xxxx*

Specifies the time interval of traps sent out for existing, predefined conditions. The valid range is 10 to 3600 seconds, in 10-second increments. Default value is 10.

portlife *xx*

Specifies the lifetime of a node list entry in seconds. The maximum value is 42,949,672 seconds (approximately 497 days), and the default is 900 seconds.

trflife *xx*

Specifies the lifetime of a traffic matrix entry in seconds. The maximum value is 42,949,672 seconds (approximately 497 days), and the default is 1200 seconds.

max-nodes-per-port *nn*

Specifies the number of nodes that can be associated with one port. The default is 800.

node *<xxxxxxxxxxxx> <slot#> <port#>*

A list of nodes allowed on the network. Each entry must occupy a separate line, up to a maximum of 800 entries. Each parameter consists of the 12-digit hexadecimal MAC address of the node, followed by its slot number and port number. A slot or port number of zero, or a blank, is treated as a "wild card," indicating "any slot" or "any port." For example, the entry `node 013489ABCDEF 4 0` specifies that any port associated with slot 4 on the hub with MAC address 013489ABCDEF is allowed on the network.

allow-on *conc|slot|port*

Enables the allowed nodes feature and specifies the level of security. You can enable allowed nodes at the hub (concentrator), slot, or port level. The system default for the Allowed Nodes feature is Off; to enable the feature and select a level, uncomment the appropriate line in the configuration file. You can select only one level at a time.

port *<slot#> <port#> <action#>*
slot *<slot#> <action#>*
conc *action#*

These three keywords specify actions to be taken when a security violation occurs, either at a specific port (identified by both slot number and port number), at a particular slot, or for the entire hub. The action to be taken is identified by one of these numbers:

2 = take no action
3 = send a trap
4 = partition the port
5 = send a trap and partition the port

security-config-lock *on|off*

Locks or unlocks access to the security configuration via the network management user interface. When this keyword is set on, you cannot change Allowed Nodes settings through the network management user interface unless you change the configuration setting through a connection to the Model 281xSA hub service port. Valid choices are on and off. The default is off.

threshold *IN OB SL PO TY CN SV AC DU*

Adds an entry to the threshold table. For a complete discussion of thresholds and threshold table entries, see the publications that came with your network management software. The fields for this parameter are:

IN = Index number, from 1 to 160, inclusive. The maximum number of table entries is 160.

OB = Object of threshold; valid entries in this field are conc (concentrator or hub), slot, or port.

SL = Slot number, from 1 to 5, inclusive.

PO = Port number, from 1 to 17, inclusive.

TY = Type of threshold. Thresholds can be set for good bytes, good packets, bad packets, CRC error packets, misaligned packets, runt packets, fragments, too-long packets, collisions, late collisions, link status, multicast packets, broadcast packets, short events, source address changes, data rate mismatches, network errors, backoff errors, and ratios of certain errors to good packets.

CN = Threshold condition that triggers response or action specified by the AC field. Response can be triggered each time the actual value crosses the set value; when the actual value is greater than the set value; when the actual value per second is greater than the set value per second; when link status changes for a port; or when an actual rate or ratio is greater than the set rate or ratio.

SV = Set value for the threshold. This can be an absolute number or a rate, depending on the *TY* field entry.

AC = Action triggered by the threshold. The action can be to send a trap; to partition a slot or port; or to send a trap *and* partition a slot or port.

DU = Duration, in seconds, of the period during which the threshold is being monitored. This value is entered in multiples of 10 seconds.

hello-message *on|off*

Enables or disables the automatic network topology buildup, by enabling or disabling the concentrator's "hello message." Valid choices are on and off. The default is on.

rmon-max-host *xxx*

Specifies the maximum number of hosts that will be collected by the agent on an interface on behalf of each RMON hostControlEntry in the RMON host group. The number is a value between 100 and 2048, inclusive. The default is 100.

Appendix H System Messages

This appendix lists the following two types of system messages:

- Operation codes that are displayed on the system operation display on the front panel of the Model 281xSA hub
- Error and informational messages that are displayed on a terminal connected to the Model 281xSA hub service port

System Operation Display Messages

The front panel of the Model 281xSA hub features a four-character alphanumeric display that indicates operational status as the hub is booting and running. Table H-1 shows the messages and their meanings.

Table H-1. System operation messages

Display	Meaning
DIAG	Hub is performing an internal hardware diagnostic check.
BOOT	System is trying to obtain boot information.
LOAD	System is loading the configuration file or image file.
INIT	System image code is initializing itself.
CNMI	System is initializing the cascade network management interface (CNMI) to other cluster-attached hubs.
PART	System is setting the partition status determined by data stored in NVRAM.
DNLD	System is preparing to download the agent file.
RAM1 RAM2	System is testing DRAM.
NVR	System is testing NVRAM.
FLSH	System is testing flash memory.
NIC	System is testing the network interface controller (NIC) chip.
MENU	System is displaying boot firmware service port menus.
nn (Network Traffic)	Hub is operating normally (that is, not in any of the other states described in this table) and the percentage of network use is indicated by *nn*.

During normal hub operation, the display shows the percentage of network use, rounded to the nearest integer and displayed as a two-digit number in the two far left display positions. When the percentage of network use is less than 1 percent, this value is displayed as <1, to indicate that the network is still operational.

The value is refreshed once per second. The far right display position indicates progress by displaying a sequence of characters (| / — \) that looks like the spokes of a turning wheel.

If a boot code error occurs, the display shows the code for the most recent test the hub attempted. If an error prevents the Model 281xSA hub from operating properly following the boot sequence, the numeric "percent utilization" display freezes.

Service Port Boot Messages

The messages listed in this section are associated with conditions that occur while the Model 281xSA hub is booting or while you are using the boot configuration menus to change boot configuration parameter values. You should only see these messages *before* the Model 281xSA hub image code is loaded.

TFTP Error and Information Messages

The messages in this section indicate problems locating and loading configuration or image file data.

Bad TFTP packet opcode([hexnum]) received from host!

The Model 281xSA hub received an invalid opcode from the boot server. The server TFTP software may be malfunctioning. If you have another server available, try booting from it.

Boot/Load aborted by user.

This informational message appears in the Boot main menu after you have pressed [Ctrl]+C on the keyboard of the terminal connected to the service port. This message indicates that you have aborted the normal boot process.

BOOTP Image file name too long!
Maximum file length 128 chars, actual length [integer] chars.

You have entered an image filename that is too long. The Model 281xSA hub allows only a 128-character name.

BOOTP timed out!

The Model 281xSA hub sent eight BootP requests at two-minute intervals and received no reply. Either the BootP server is not functioning or the BootP request packet from the Model 281xSA hub is not reaching the server.

Failed to load config file.

The configuration file was not found, it was the wrong configuration file, or the server IP address was incorrect.

Failed to load image file.

The image file was not found, it was the wrong image file, or the server IP address was incorrect.

Image load Err:Netload fmt start addr !=Image param block start addr!
Netload addr: [hexnum], Image Param block: [hexnum].

The image code was successfully downloaded, but the image is not valid. The most likely cause is an invalid image file on the server.

Incorrect Image for platform

The image code was successfully downloaded, but the image is not valid. The most likely cause is an invalid image file on the server.

Invalid IP address format.

You entered an improperly formatted IP address. A proper IP address consists of four decimal integers, each between 0 and 255 inclusive, and separated by periods. For example, 128.77.66.0 is a valid IP address.

Invalid Netload descriptor type: [integer].

The internal structure of the image file is not valid. The most likely cause is an invalid image file on the server.

No image file name found in config file.

The image filename is assumed to be in the first noncomment line in the configuration file. This message means that the firmware scanned through the configuration file without finding a noncomment line.

TFTP block received out of sequence!
Expected [integer], received [integer].

Each received TFTP block has a sequence number, and the boot firmware expects them to occur in ascending sequence. This is not a fatal error; the system tries again. The server TFTP software may be malfunctioning. If you have another server available, try booting from it.

TFTP block shorter than four bytes!

The boot firmware has received an invalid TFTP packet. The server TFTP software may be malfunctioning. If you have another server available, try booting from it.

TFTP error received from remote host!
Remote Error: [string from server].

The boot server sent an error message to the Model 281xSA hub firmware. A typical remote error would be “File not found.”

Timed out trying to TFTP!

Either the Model 281xSA hub tried to open the TFTP connection eight times, or more than two minutes passed between packets inside a TFTP transmission.

Unexpected short Netload packet!
Header (Descriptor) packet expected!

The internal structure of the image file is not valid. The most likely cause is an invalid image file on the server.

Memory Error Messages

The messages in this section indicate problems with the memory subsystems on the Model 281xSA hub: DRAM, EPROM, flash EEPROM, and NVRAM.

Bad BOOT EPROM checksum!
Actual Checksum: [hexnum], needed checksum [hexnum].

The BOOT EPROM checksum is checked at program startup/power-up time. This failure means that the BOOT EPROM is defective.

Bad checksum.
Bad block index.
Empty block.

The configuration data in the NVRAM has been corrupted, which can happen if power fails at the instant the configuration is being saved. The Model 281xSA hub will try to rewrite the NVRAM to factory default settings. If it succeeds, continue to use the NMM. If the error repeats, contact the Customer Service department of the organization from which you purchased your System 2000 equipment.

NOTE: *If this error happens, you will need to reprogram the configuration data. Use the k command [Reset NVRAM to factory defaults] in the Boot Main Menu.*

Invalid flash checksum!

The flash memory checksum (32 bits) is checked at program startup/power-up time. This failure means that the local image in flash memory is invalid. The Model 281xSA hub firmware automatically sets the image load mode to REMOTE if this failure occurs.

Reset Message

This message appears when you reset the Model 281xSA hub.

Waiting for Wdog to reset the NMM…

This informational message indicates that the Model 281xSA hub is not running and is waiting for the hardware to detect the failure and reset the Model 281xSA hub.

Service Port Run-time Messages

The messages listed in this section are associated with conditions that occur while you are using the run-time configuration menus to change configuration parameter values. You should see these messages only after the Model 281xSA hub image code has loaded.

c-init: Can't read MAC address PROM

This error message indicates that the MAC address from the MAC address PROM. It might occur if there is a problem with the MAC address PROM hardware.

IPX node address has to be exactly 12 hexadecimal digits, hit <space> to continue

You have entered an IPX trap receiver node address that is an incorrect length.

IPX node address has to be hexadecimal number, hit <space> to continue

You have entered an IPX node address that was not in the correct form. It should contain only hexadecimal digits.

Segment number has to be exactly 8 hexadecimal digits, hit <space> to continue.

You have entered an IPX segment number that is not a correct length.

Segment number has to be hexadecimal number, hit <space> to continue.

You have entered an IPX segment number that is not in the correct form. It should contain only hexadecimal digits.

Warning: Can't write hardware configuration data to EEPROM.

The hub hardware configuration could not be written to NVRAM successfully. This error might occur if there is a problem with the NVRAM hardware.

Warning: Hardware configuration in slot xx has changed since last restart.

This informational message indicates that the specified slot was reconfigured since the last Model 281xSA hub image code restart.

Warning: Invalid or missing EEPROM. Use default value.

This error message indicates that values could not be read from NVRAM

Writing configuration data to EEPROM . . . OK
Writing configuration data to EEPROM . . . Failed

These messages indicate whether or not the configuration data was successfully written to NVRAM. The operation might fail if there is a problem with the NVRAM hardware.

Writing values to EEPROM . . . OK
Writing values to EEPROM . . . Failed

These messages indicate whether or not the write-to-EEPROM request succeeded. The request might fail if there is a problem with the NVRAM hardware.

Configuration File Messages

The messages in this section are associated with conditions that occur while you are using the downloaded agent configuration file to change configuration parameter values. You should see these messages only after the Model 281xSA hub image code has loaded.

authentication-traps Unknown argument, xxxx, ignored.

An unknown parameter is specified for the authentication-traps keyword in the configuration file. In this case, the system defaults to authentication-traps-on.

Bad data format in: xxxxx, ignored.

When this error message contains one of the following keywords in place of xxxxx, the message indicates that no entry will be created in the allowed-nodes table:

- **node**
- **port**
- **slot**
- **conc**

When this error message contains one of the following keywords in place of xxxxx, the system uses the default value for the specified keyword:

- **allow-on**
- **portlife**

- **trflife**
- **max-nodes-per-port**

When this error message contains the keyword **threshold** in place of xxxxx, the message indicates that no entry will be created in the threshold table.

bad IP address xxxx
An incorrect IP address is specified as a parameter to one of the following keywords:

- **netmask**
- **primary-default-router**
- **secondary-default-router**
- **boot-router**

baud-rate Unknown argument, xxxxx, ignored.
An unknown parameter is specified for the baud-rate keyword in the configuration file. In this case, the system defaults to baud-rate 9600.

boot-protocol Unknown argument, xxxxx, ignored.
You have entered a parameter value other than those allowed for this keyword. The system will use the default value for the specified keyword.

boot-mode Unknown argument, xxxxx, ignored.
You have entered a parameter value other than those allowed for this keyword. The system will use the default value for the specified keyword.

Colon missing between network # and host # in IPX trap receiver
The IPX address is incorrectly formatted in the IPX trap receiver table. Make sure you type a colon (:) between the network number and the node address.

config-load-mode Unknown argument, xxxxx, ignored.
An unknown parameter is specified for the config-load-mode keyword in the configuration file. In this case the system defaults to remote-with-local-backup.

hello-message Unknown argument, xxxx, ignored.
You have entered a parameter value other than on or off (the only valid parameters) for this keyword. The system will use the default value (on) for this keyword.

Illegal hello timer xxxx
The timer value contains non-numeric characters.

Illegal ping timer xxxx
The timer value contains non-numeric characters.

Illegal trap interval xxxxx.
The trap interval value is out of range.

Illegal trap receiver ageout time xxxx.
The ageout time contains one or more non-numeric characters.

image-load-mode Unknown argument, xxxxx, ignored.
An unknown parameter is specified for the image-load-mode keyword in the configuration file. The system will use the default value for this parameter.

IPX trap table is full. Max of 10.
The IPX trap receiver table is full.

Local image does not exist. image-load-mode argument, xxxxx, ignored.
The image-load-mode keyword has been set to local-only or remote-with-local-backup when the local image is not present locally. This failure might be due to a flash EPROM failure. The system will use the default value for this parameter.

management-protocol Unknown argument, xxxxx, ignored.
You have entered a parameter value other than those allowed for this keyword. The system will use the default value for the specified keyword.

ping-message Unknown argument, xxxx, ignored.
You have entered a parameter value other than on or off (the only valid parameters) for this keyword. The system will use the default value (on) for this keyword.

Segment number has to be hexadecimal number.

You have specified an IPX network number in an incorrect form. Only hexadecimal digits are allowed.

trap-interval Unknown argument, xxxxx, ignored.

You have entered a parameter value other than those allowed for this keyword. The system will use the default value for the specified keyword.

trap-table is full. Max of 10.

The IP trap receiver table is full.

Unknown command, xxxxx, ignored.

An unknown agent configuration keyword has been found in the downloaded agent configuration file. The system ignores invalid keywords.

Appendix I Replacing SIMMs

Model 281xSA dynamic random access memory (DRAM) can be upgraded from the default 2-megabyte (MB) configuration to a total of 8 MB. The DRAM consists of a single in-line memory module (SIMM) that is installed in a SIMM socket on a printed circuit board inside the hub.

This appendix outlines the procedures for replacing a SIMM in the Model 281xSA hub. This appendix includes the following information and procedures:

- Preparing for the installation procedure
- Removing the cover of the hub
- Replacing a SIMM
- Setting the DRAM configuration jumpers
- Reinstalling the cover
- Verifying installation

CAUTION: *System 2000 equipment uses electronic components that are sensitive to static electricity. Static discharge from your clothing or other fixtures around you can damage these components. You should take all possible precautions to prevent static discharge damage when working with printed circuit boards.*

If possible, place all printed circuit boards on an antistatic mat until you are ready to install them. If you do not have an antistatic mat, wear a discharge leash to free yourself of static before touching any of the printed circuit boards, or free yourself of static by touching the metal of the chassis before handling a module.

Preparation

Before you begin installing the SIMMs, make sure you have the necessary tools and equipment. Follow the instructions under “Preparatory Steps” to prepare the hub for the installation procedure.

Tools and Equipment

You will need the following tools and equipment during the installation procedure:

- A #2 Phillips screwdriver for removing the rack-mounting screws if the hub is rack mounted
- A screwdriver for loosening the wall-mounting screws if the hub is wall mounted
- A #1 Phillips screwdriver for removing the hub cover
- An antistatic mat and wrist strap (attached to an antistatic leash)

Preparatory Steps

If you are upgrading the memory in a hub that has been in operation, you should take the necessary precautions to ensure that users’ sessions are not disrupted and that appropriate safety measures have been followed. Before beginning the upgrade, follow these steps:

1. **Instruct network users to save their work and log out of active session applications.**
2. **Turn off the power to the concentrator.**
3. **Disconnect the power cord, first from the wall outlet and then from the hub.**
4. **If the hub is installed in a rack or on a wall, remove the hub from its installed location.**
    a. For a rack-mounted hub, remove the screws that secure the hub to the equipment rack and slide the hub out of the rack.
    b. For a wall-mounted hub, loosen the screws that support the wall mount brackets, and lift the hub and attached brackets off the screws.
5. **Set the hub on a level work surface.**

Removing the Cover

To gain access to the SIMM socket, you must remove the cover from the Model 281xSA hub. To remove the cover, follow these steps:

1. **Using the #1 Phillips screwdriver, remove 3 screws from each side and 6 screws from the rear of the hub (see Figure I-1).**

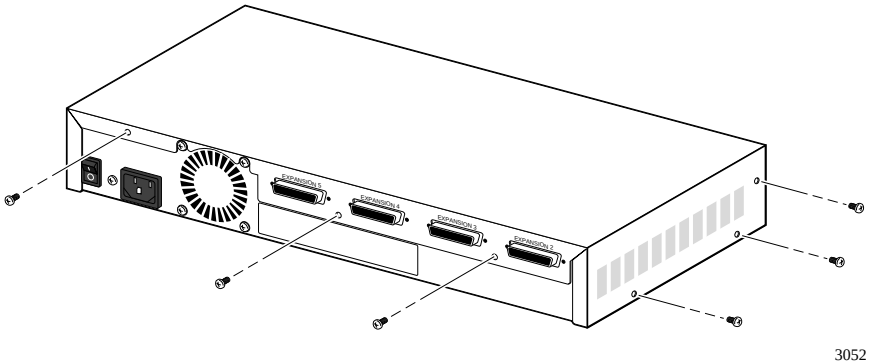


Figure I-1. Cover retaining screws

2. Holding the sides of the cover, slide the cover toward the rear of the hub approximately 1/2 inch (see Figure I-2).

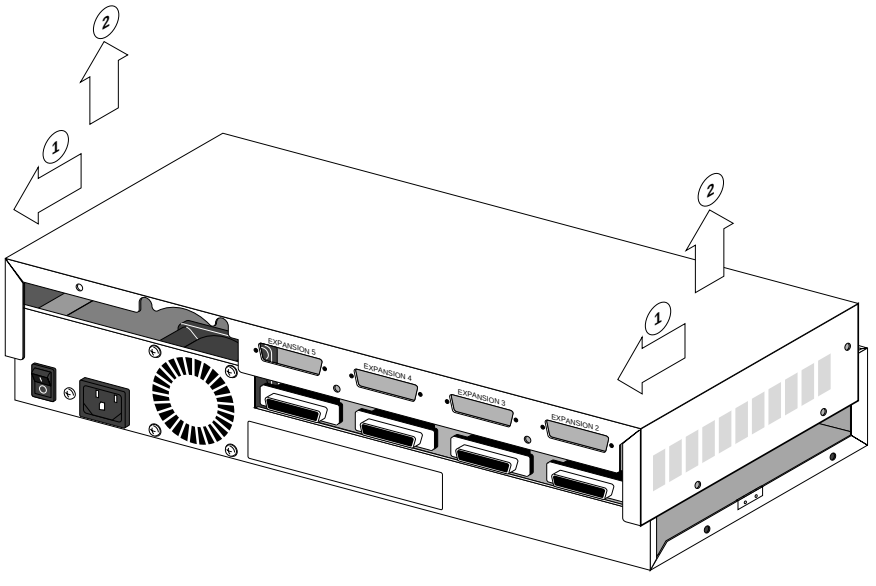


Figure I-2. Removing the hub cover

3. Lift the cover straight up and remove it from the hub. Set the cover aside.

Replacing the SIMM

The DRAM SIMM is installed in a SIMM socket labeled U21 on the printed circuit board that is just under the hub cover. You need to remove the SIMM already installed on the board before installing a new SIMM.

Model 281xSA hubs use 72-pin SIMMs. SIMM capacity is a function of the number and type of memory devices on the SIMM.

There are currently three SIMM capacities that can be installed on the Model 281xSA hub (see Table I-1).

Table I-1. DRAM SIMM capacities and types

SIMM capacity and type	Memory device type	SIMM manufacturer	SIMM part number
2 MB (2 sides)	512 Kb × 32, 70 ns	Texas Instruments	TM512CBK32-70
		Motorola	MCM32512SG70
		NEC	MC-42512A32F-70
		Micron	MT16D51232G-7
4 MB (1 side)	1 Mb × 32, 70 ns	Texas Instruments	TM124BBK32-70
		Motorola	MCM32130SHG70
		NEC	MC421000A32F-70
		Hitachi	HB56D132BR-7A
		Micron	MT8D132G-7
8 MB (2 sides)	2 Mb × 32, 70 ns	Motorola	MCM32230SHG70
		NEC	MC-422000A32F-70
		Hitachi	HB56D232BS-7A
		Micron	MT16D232G-7

Total memory varies and depends on the type of SIMM installed.

To replace the SIMM, follow these steps:

1. Locate the SIMM socket at location U21 on the circuit board.

Locate socket U21 (see Figure I-3). Socket U21 is a “tilt-down” SIMM socket—you insert the SIMM into the empty socket vertically and then tilt the SIMM back until it snaps into the socket.

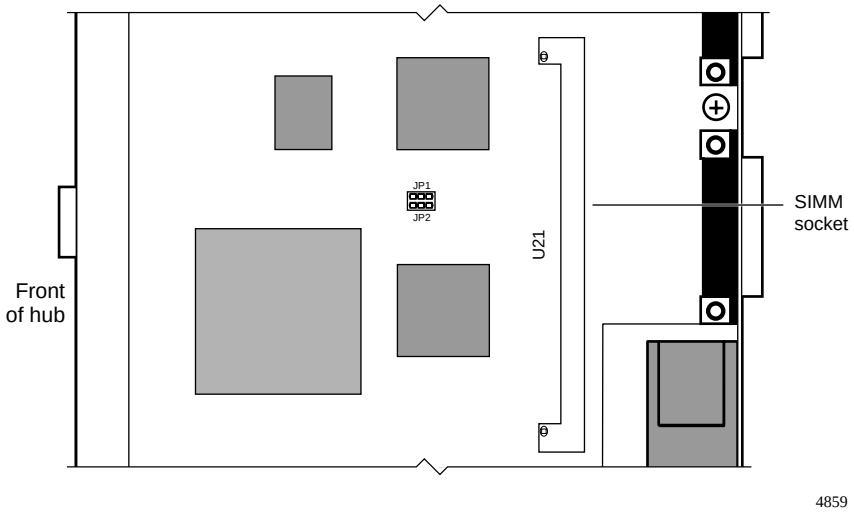


Figure I-3. SIMM location

CAUTION: *If you do not wear a discharge leash to free yourself of static before touching the circuit board or the SIMM, free yourself of static by touching the metal of the chassis before handling the NMM and the SIMM.*

2. Remove the SIMM that is already installed in the socket (see Figure I-4).

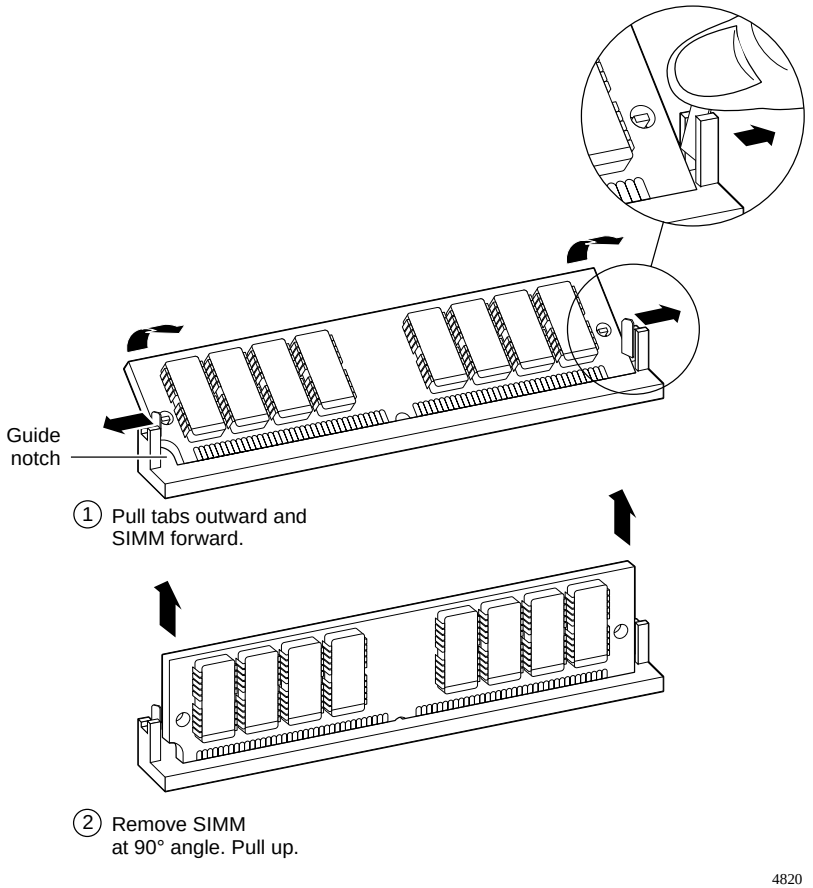


Figure I-4. Removing a SIMM

a. Push gently outward on the spring latch at each end of the SIMM.

   When you release the SIMM from the spring latches, the SIMM ejects from the locking studs on the socket and can be easily removed.

b. Tilt the SIMM to its vertical position and lift it out of the socket.

c. Note the location and orientation of the SIMM guide notch on the left end of the SIMM.

When you install the replacement SIMM, the guide notch must match the position and alignment of the guide notch on the SIMM you removed.

d. Place the removed SIMM in an antistatic bag, or set it on an antistatic mat.

3. Install the replacement SIMM (see Figure I-5).

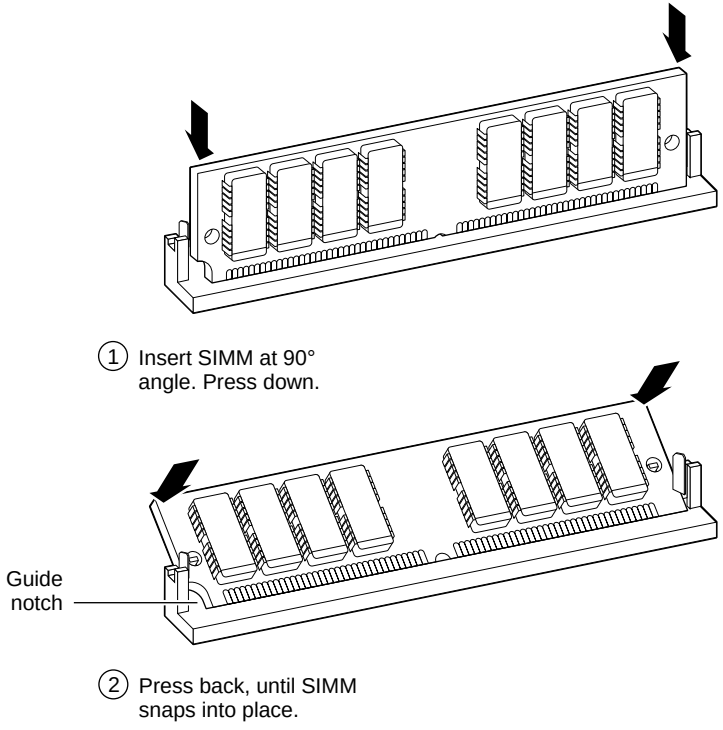


Figure I-5. Installing a SIMM

a. Hold the replacement SIMM by its top corners, with the guide notch toward the bottom edge of the NMM.

b. Align the SIMM vertically above the socket and lower the SIMM gently into the socket.

c. Push the SIMM gently down and in to seat it firmly in the socket.

   The SIMM is keyed to prevent incorrect installation. Do not force it if it does not slide easily into the socket.

d. Tilt the SIMM into its locked position.

   You may hear a "click" as the spring latches engage the ends of the SIMM.

NOTE: *You may feel a slight resistance as the SIMM comes to its locked position. If the SIMM does not lock, do not force it. Remove the SIMM, reinsert it, wiggle it gently as you press it into the socket, and try to tilt it into its locked position. It is very easy to damage the SIMM socket by forcing a SIMM into its locked position.*

4. Set the DRAM configuration jumpers to match the memory you have just installed, as described in "Setting Jumpers."

NOTE: *The hub self-tests include an optional, exhaustive DRAM self-test. This test is turned off by default. You should turn this test on to check the newly installed memory. For information on activating this self-test, see "Boot Configuration Menus" in Chapter 4, "Configuring the Model 281xSA Hub for IP/IPX Networks."*

Setting Jumpers

When you have finished installing the new SIMM, you must set the DRAM configuration jumpers (see Figure I-6) to match the amount of memory on the SIMM.

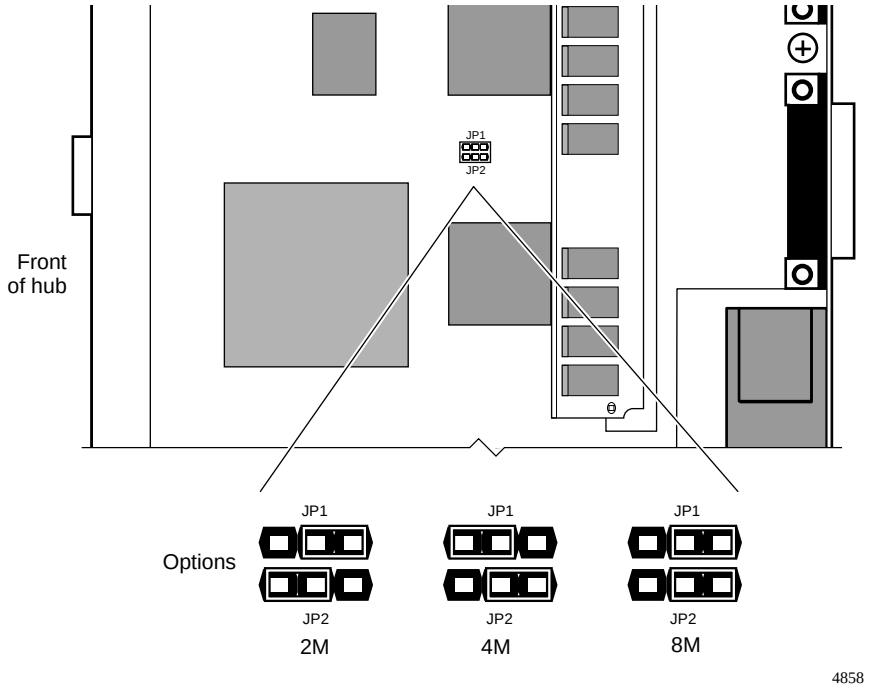


Figure I-6. DRAM jumpers

Set the jumpers at locations JP1 and JP2 to match the memory configuration you have installed, as shown in Table I-2.

Table I-2. Jumper settings for total memory

Total Memory	JP1 position	JP2 position
2 MB (default)	1–2	2–3
4 MB	2–3	1–2
8 MB	1–2	1–2

Other jumpers on the board are set at the factory and should not be changed.

Reinstalling the Cover

When you have installed the SIMM and set the jumpers, you must reinstall the cover on the Model 281xSA hub. To reinstall the cover, follow these steps:

1. **Set the cover over the top of the hub, making sure the back edge of the cover clears the expansion ports on the rear panel of the hub (see Figure I-7).**

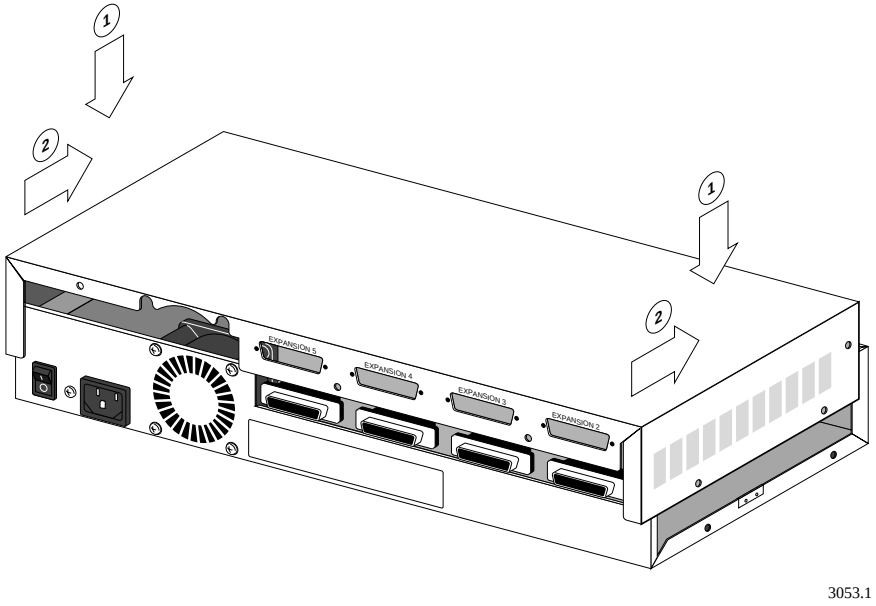


Figure I-7. Reinstalling the cover

2. **Holding the sides of the cover, slide the cover toward the front of the hub until the cover engages with the chassis edges.**

NOTE: *Be careful of the ribbon cables that run between boards at the side of the hub. If the ribbon cables interfere with the installation of the cover, gently push them to the inside of the hub as you lower the cover onto the hub.*

3. **Using the #1 Phillips screwdriver, insert and tighten 3 screws on each side of the hub and 6 screws across the back (see Figure I-8).**

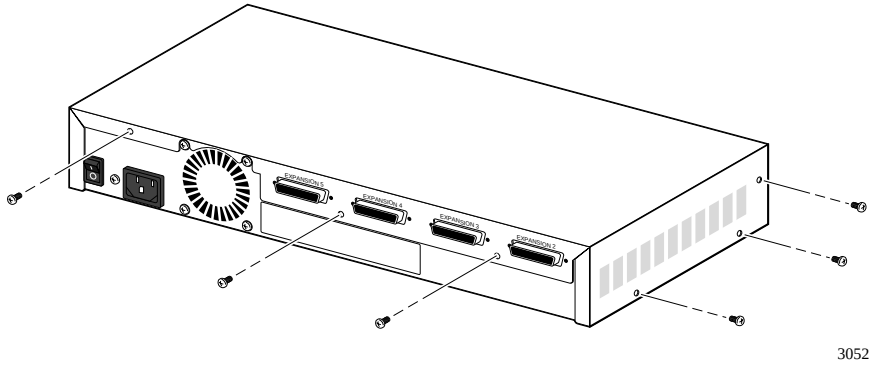


Figure I-8. Cover retaining screws

Final Steps

When the hub is reassembled, reinstall the hub in a rack or on a wall, if necessary, and verify correct operation of the hub. For instructions on hub installation, see Chapter 2, “Installing the Model 281xSA Hub.”

To verify correct hub operation, follow these steps:

1. **Connect the power cord, first to the Model 281xSA hub and then to a power outlet.**
2. **Turn on the power to the hub.**
3. **Check the LEDs and system operation display, as described in Appendix B, “LEDs and Switches.”**

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